

PRELIMINARY DATA REPORT
BRENTON REEF
WELLFLEET
NORWALK
DISPOSAL SITES
AUGUST 1981

CONTRACT #
DACW33-81-C-0115

Submitted to:

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1.0 INTRODUCTION

During August 1981 Science Applications, Inc. (SAI) conducted survey operations as part of the Disposal Area Monitoring System (DAMOS) at three disposal sites in the New England area. Operations at the Brenton Reef Site in Rhode Island Sound and the Wellfleet Site in Cape Cod Bay were conducted from the R/V SCHOCK under charter from the University of Rhode Island. Measurements at the Norwalk Site in the Central Long Island Sound Disposal Area were made from the R/V UCONN under charter from the University of Connecticut.

At all three sites, precision bathymetric surveys were conducted over previously established survey tracks to determine small scale changes in bottom topography. Sediment samples were obtained at specified points for determination of chemical properties and for assessment of benthic population parameters. Visual observations and bottom photographs were obtained by divers at all sites and water samples were taken one meter above the bottom at high and low tide both over the spoil mound and at a reference station.

The purpose of this report is to document the sampling procedures used during these surveys and to present preliminary results of these measurements.

2.0 INSTRUMENTATION

Navigation control for these surveys was provided by a Del Norte Model 540 Trisponder interfaced with the SAI Navigation and Data Acquisition System. This system provides

position information with accuracies on the order of ± 3 meters over the ranges encountered in this study. Depth measurements were made with an Edo Western Model 248 survey fathometer operating at a frequency of 24 KHz and a model 261C Digitrak depth digitizer. This system typically records depths at an accuracy of ± 25 cm with a resolution of 5 cm.

All of the navigation and depth data are recorded on disk for processing with software to provide precision bathymetric information over replicate survey tracks which can be used to determine changes in dredged material distribution within the disposal area.

Furthermore, the accurate navigation system is used in conjunction with a helmsman's aid display to obtain replicate sediment samples within a radius of approximately 10 to 15 meters for chemical and biological analysis. Samples were taken with a Smith-MacIntyre grab sampler which provides a relatively undisturbed sediment sample of $1/10 \text{ m}^3$ volume. Subsamples of these grabs were then taken for analysis of heavy metal content and grain size. The remainder of those samples taken for biological studies were sieved through a 1 mm screen, treated with 10% formalin solution and stored for later sorting, identification and analysis.

3.0 BRENTON REEF DISPOSAL SITE

Surveys at the Brenton Reef Disposal site were conducted during the week of August 3, 1981. Shore stations for the Trisponder system were established at the Beavertail Light located at $41^{\circ} 26.95' \text{N}$, $71^{\circ} 23.99' \text{W}$ and Point Judith Lighthouse

located at $41^{\circ} 21.65'N$, $71^{\circ} 28.91'W$. A bathymetric survey was set up based on the tracks previously run in August 1978. Although the same lanes with 50 meter spacing oriented from NE to SW were used, they were shortened by 300 meters on the north end and lengthened by 500 meters on the south end to provide coverage over the area proposed for disposal of additional material.

On August 5, a bathymetric survey was run which covered a 3400 km^2 area centered about $41^{\circ} 23.18'N$, $71^{\circ} 18.6'W$ (Figure 3.0-1). During the survey, evidence of past dumping operations was clearly evident on the fathometer record, however, problems with analysis of the bathymetric data have prevented presentation of a complete depth contour chart at this time. Portions of the fathometer record on lanes 12 and 13 which clearly depict the spoil mound are presented in Figures 3.0-2 and 3.0-3 respectively. Complete bathymetric contour plots will be provided as soon as the analysis problems are resolved.

Sediment samples were obtained at the locations defined in Table 3.0-1 and shown in Figure 3.0-1. The distribution of samples was determined by developing a profile from the center of the disposal mound (BR-CTR) to the Reference Station (BR-REF). Based on these samples, stations on the margin of the spoil mound (BR-300SW) and on natural bottom adjacent to the spoils (BR-1000 SW) were established. Five replicates were then obtained at each of these stations for benthic analysis. In addition, random samples distributed over the south and east portions of the survey area were obtained to provide baseline data on sediment characteristics and benthic populations. At each of these random stations three replicate samples were obtained.

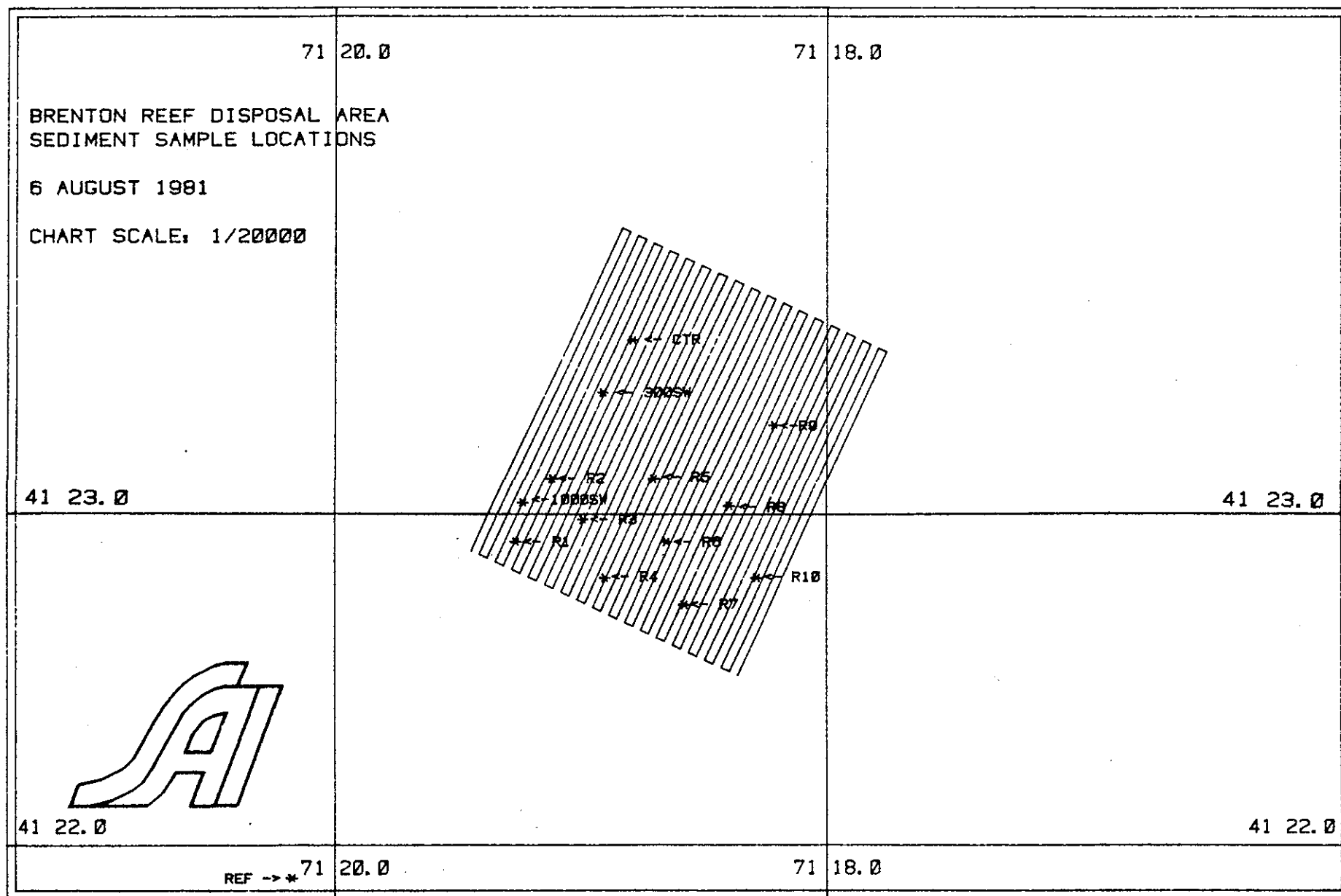
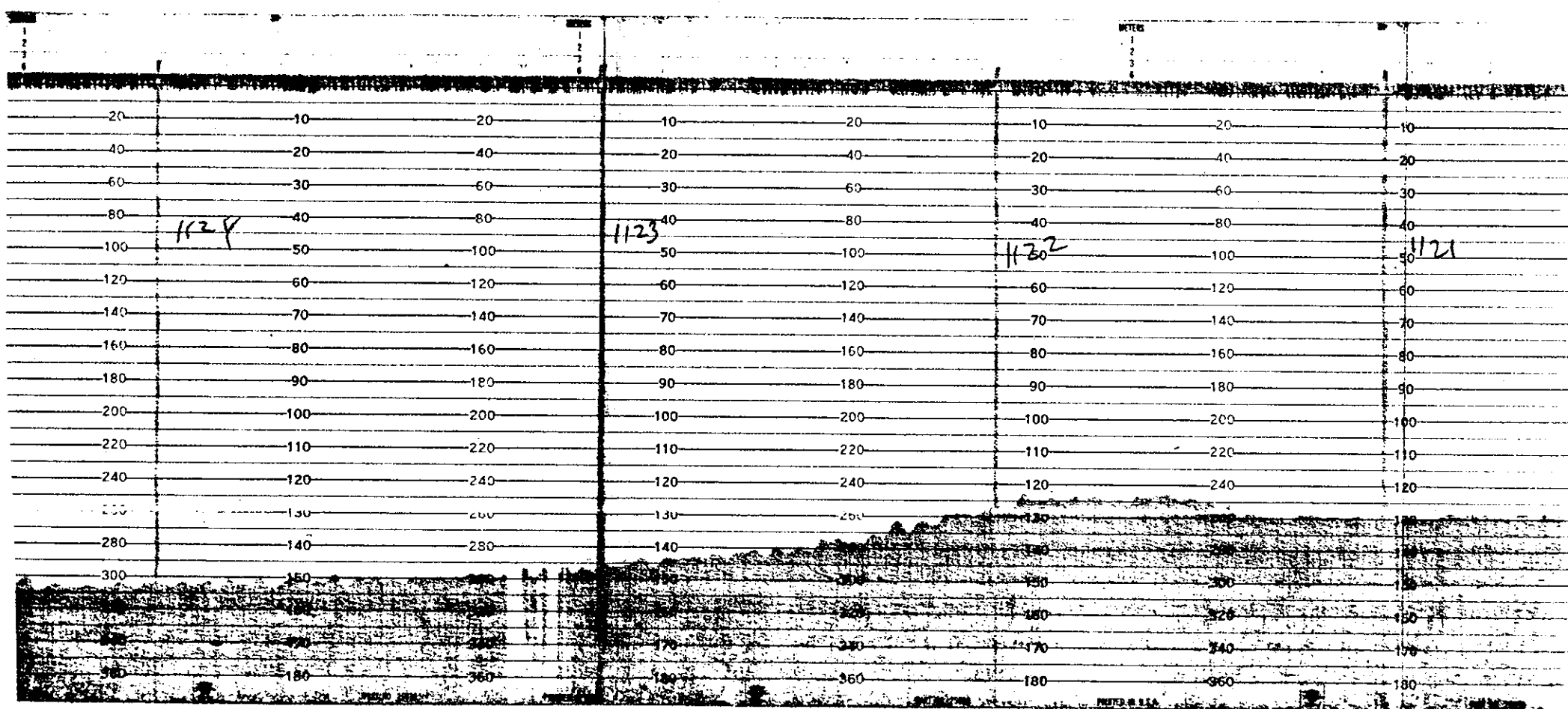
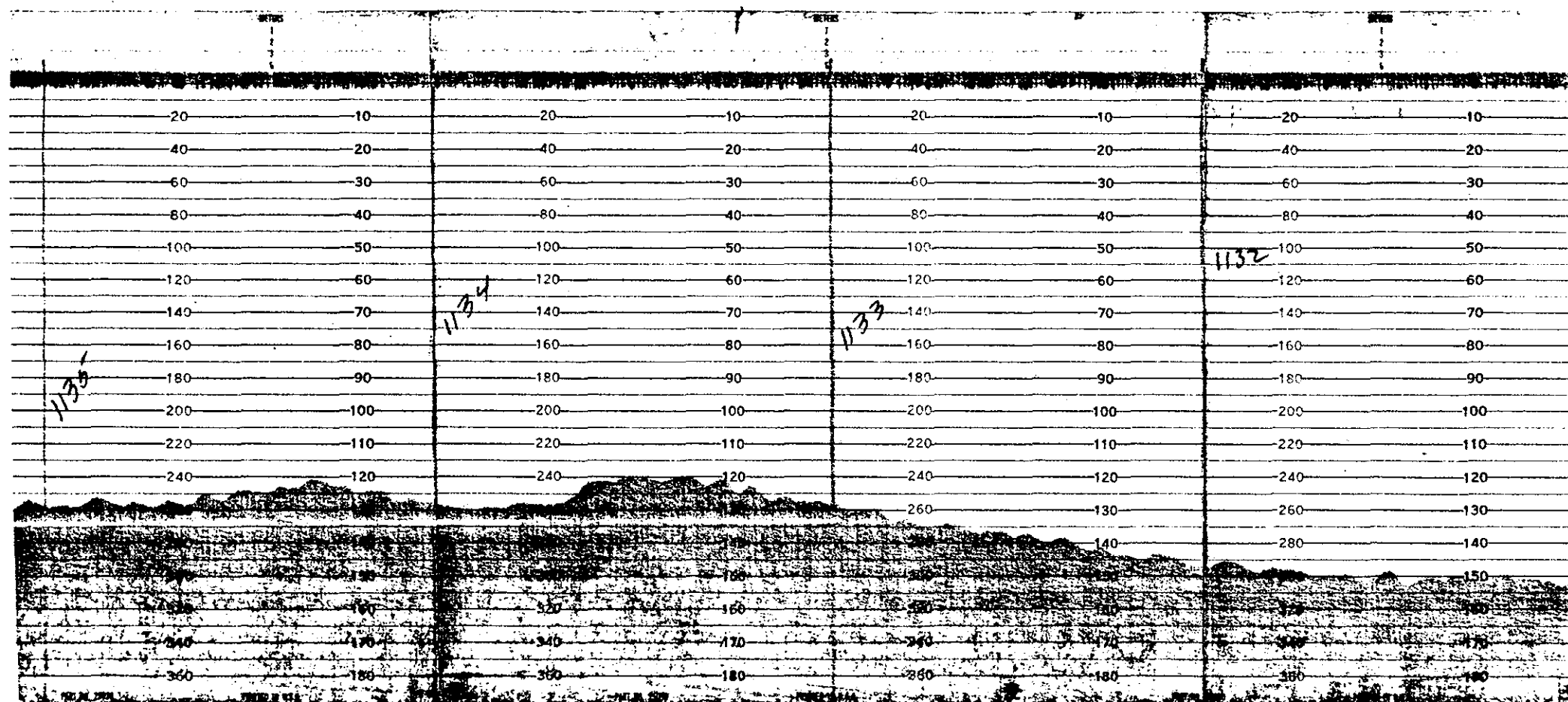


Fig. 3.0-1



VERTICAL DEPTH PROFILE
BRENTON REEF DISPOSAL SITE
LANE 12
AUGUST 1981

Fig. 3.0-2



VERTICAL DEPTH PROFILE
BRENTON REEF DISPOSAL SITE
LANE 13
AUGUST, 1981

<u>SAMPLE</u>	<u>LATITUDE</u>	<u>LONGITUDE</u>	<u>NUMBER</u>	<u>TYPE</u>
BR-CTR	41°23.524'	71°18.790'	1159	HM
BR-150-SW	41°23.443	71°18.850	1160	HM
BR-300-SW	41°23.363	71°18.906	1161	HM
BR-450-SW	41°23.310	71°18.967	1162	HM
BR-600-SW	41°23.233	71°19.025	1163	HM
BR-750-SW	41°23.170	71°19.084	1164	HM
BR-1000-SW	41°23.029	71°19.226	1165	HM
BR-1500-SW	41°22.808	71°19.405	1166	HM
BR-2000-SW	41°22.578	71°19.599	1167	HM
BR-2500-SW	41°22.376	71°19.836	1168	HM
BR-3000-SW	41°21.900	71°20.170	1169	HM
BR-CTR-A	41°23.534	71°18.790	1170	GS
BR-CTR-A			1171	HM
BR-CTR-B			1172	HM
BR-CTR-B			1173	GS
BR-CTR-C			1174	GS
BR-CTR-C			1175	HM
BR-CTR-D			1176	GS
BR-CTR-D			1177	HM
BR-CTR-E			1178	GS
BR-CTR-E			1179	HM
BR-300SW-A	41°23.363	71°18.906	1180	GS
BR-300SW-A			1181	HM
BR-300SW-B			1182	GS
BR-300SW-B			1183	HM
BR-300SW-C	41°23.363'	71°18.906	1184	GS
BR-300SW-C			1185	HM
BR-300SW-D			1186	GS
BR-300SW-D			1187	HM
BR-300SW-E			1188	GS
BR-300SW-E			1189	HM
BR-1000SW-A	41°23.029	71°19.226	1190	GS
BR-1000SW-A			1191	HM
BR-1000SW-B			1192	GS
BR-1000SW-B			1193	HM
BR-1000SW-C			1194	GS
BR-1000SW-C			1195	HM
BR-1000SW-D			1196	GS
BR-1000SW-D			1197	HM
BR-1000SW-E			1198	GS
BR-1000SW-E			1199	HM
BR-REF-A	41°21.900'	71°20.170	1200	GS
BR-REF-A			1201	HM
BR-REF-B			1202	GS
BR-REF-B			1203	HM
BR-REF-C			1204	GS
BR-REF-C			1205	HM
BR-REF-D			1206	GS
BR-REF-D			1207	HM
BR-REF-E			1208	GS
BR-REF-E			1209	HM

TABLE 3.0-1. Sediment Sample Locations
Brenton Reef Disposal Site
August 1981

<u>SAMPLE</u>	<u>LATITUDE</u>	<u>LONGITUDE</u>	<u>NUMBER</u>	<u>TYPE</u>
BR-R1-A	41°22.911	71°19.255	1210	GS
BR-R1-A			1211	HM
BR-R1-B			1212	HM
BR-R2-A	41°23.101	71°19.112	1213	GS
BR-R2-A			1214	HM
BR-R2-B			1215	HM
BR-R3-A	41°22.979	71°18.986	1216	GS
BR-R3-A			1217	HM
BR-R3-B			1218	HM
BR-R4-A	41°22.803	71°18.896	1219	GS
BR-R4-A			1220	HM
BR-R4-B			1221	HM
BR-R5-A	41°23.101'	71°18.699	1222	GS
BR-R5-A			1223	HM
BR-R5-B			1224	HM
BR-R6-A	41°22.911'	71°18.645'	1225	GS
BR-R6-A			1226	HM
BR-R6-B			1227	HM
BR-R7-A	41°22.722'	71°18.574	1228	GS
BR-R7-A			1229	HM
BR-R7-B			1230	HM
BR-R8-A	41°23.019	71°18.394'	1231	GS
BR-R8-A			1232	HM
BR-R8-B			1233	HM
BR-R9-A	41°23.263	71°18.215	1234	GS
BR-R9-A			1235	HM
BR-R9-B			1236	HM
BR-R10-A	41°22.803	71°18.287	1237	GS
BR-R10-A			1238	HM
BR-R10-B			1239	HM

TABLE 3.0-1 (Continued)

Sediment samples at the center of the dredged material mound consisted mainly of fine sand overlaying a layer of cohesive clay with deposits of gravel and shell fragments. Samples taken 300 meters southwest of the center generally consisted of a 10 cm layer of fine silt over clumps of grey clay. Worm tubes were also present at this location. Samples at 1000 meters southwest of the center were composed mainly of medium sand. Sediment at the reference site consisted entirely of fine sand. Sediment samples at the random sites ranged from fine black silt at sites 3, 4, 5, 7 and 10 to gray clay and coarse gravel at site 1.

On August 6, 1981, two dives were made at the Brenton Reef Disposal Site, one near the center of the mound heading in a SW (240°) direction and a second approximately 100 meters SW of the center. Visibility on the bottom varied from .5 to 1.5 meters. At both locations, the bottom had no discernable slope.

At the center station, the bottom consisted of a soft unconsolidated brown floc layer (< 1 cm deep) overlaying a 10 cm coarse grained firm sand layer which capped an underlaying soft cohesive mud substrate. Numerous excavations (> 1 cm dia), pock marks, and tracings were evident on the surface substrate. Near the end of the transect a boulder field (cobble/boulder to .5 m diam) was encountered. Shellhash consisting of Mya and Crassostrea formed patch areas within the region. No ripple marks were detected along the transect path. At the SW dive point, the bottom was a featureless sand interface.

Biological observations indicated a similar fauna

at both sites consisting of the following organisms:

- Fish:
Winter flounder, Pseudopleuronectes americanus (5)
- Mollusk:
Moon Snail, Pollinices
- Crustacea:
Cancer borealis (20+)
Homarus americanus (4)
Pagurus longicarpus (100+)
Didhelopandalus leptocerus
- Other:
Bryozoan fouling luxuriant on hard rock surfaces,
Bugula predominant
Cerianthus americanus (burrow tubes) (5+)
Mysids (extremely abundant just off bottom).
Few patches of Maphipod (sps) tubes recorded over the 50 m transect.

Bottom photographs obtained during these dives are presented in Figures 3.0-4(a-h).

On 14 August 1981, a cage containing 20 bags of mussels was deployed near the disposal mound at Loran-C 9960 chain coordinates 5734.4 (X) 34955.9 (Y) or approximately 41° 23.65'N, 71° 17.7'W. These mussels were obtained from the reference population established at Latimer's Light in Fishers Island Sound which has been used as the source and baseline for all mussels deployed south of Cape Cod during the DAMOS program.

4.0 WELLFLEET

During the week of 10 August 1981, SAI conducted monitoring surveys of the Wellfleet Disposal Site recently established in Cape Cod Bay, Massachusetts to accommodate dredged material from Wellfleet Harbor. Operations were conducted from the R/V SCHOCK utilizing the same instruments and procedures described in Section 2.0. Shore stations for the navigation

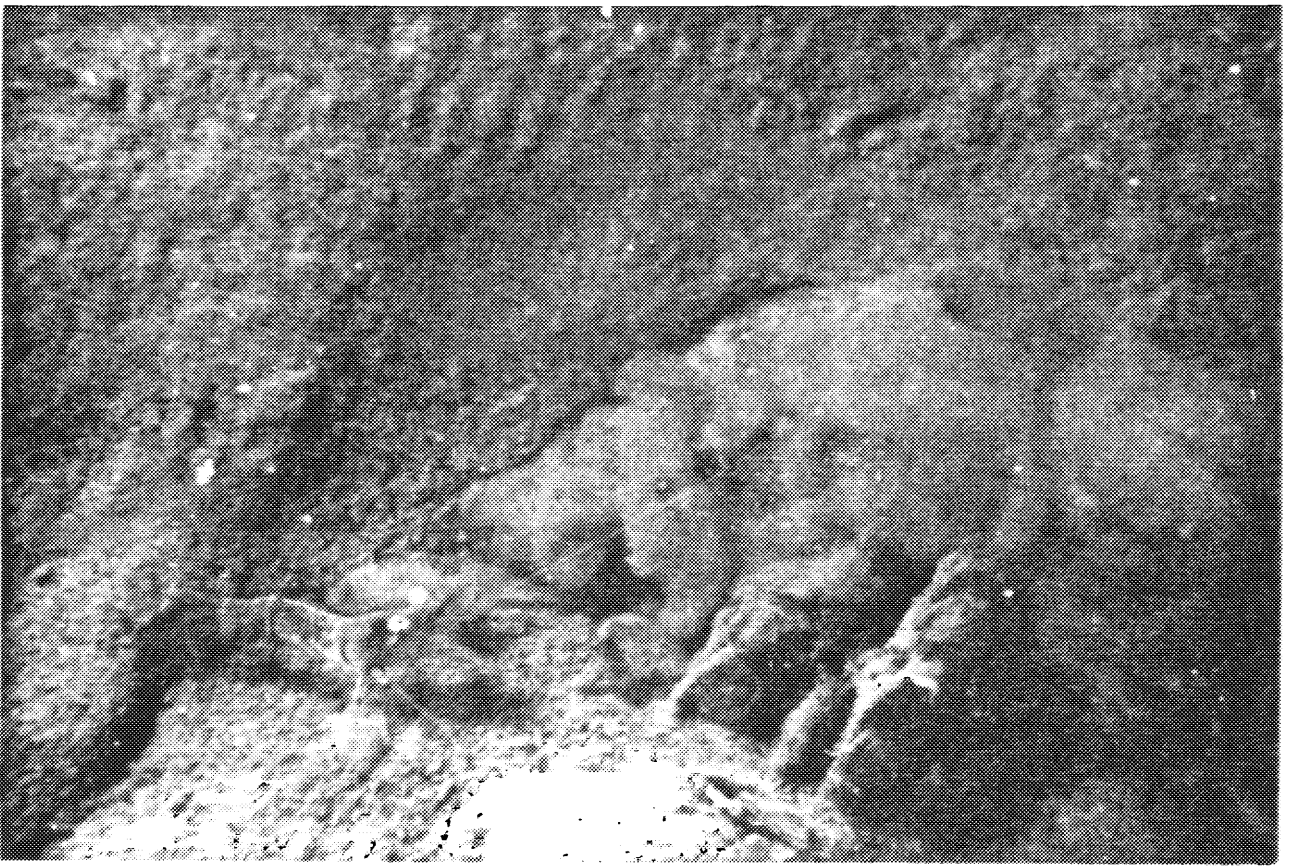


Figure 3.0-4a A boreal shrimp, Dichelophandalus leptocerus is shown within the left margin of a sediment cavity created by a burrowed hermit crab, Pagurus pollicaris. Note sediment plume created by Pagurus during feeding behavior.



Figure 3.0-4b Two boreal shrimp flank the anterior carapace of Cancer borealis, burrowed to carapace depth in the coarse sand surface cap.

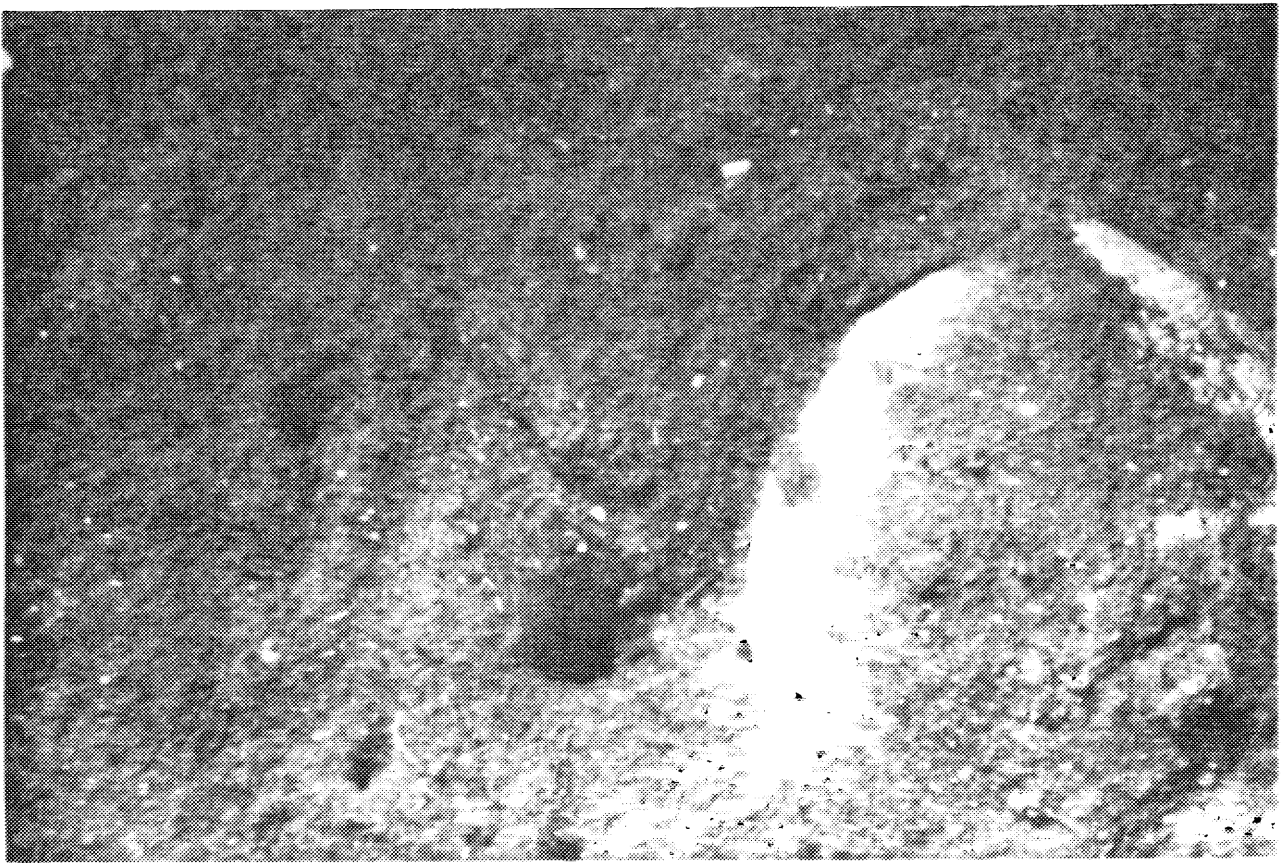


Figure 3.0-4c Homarus americanus, burrowed beneath cobble heavily fouled with hydroid and bryozoan growth.

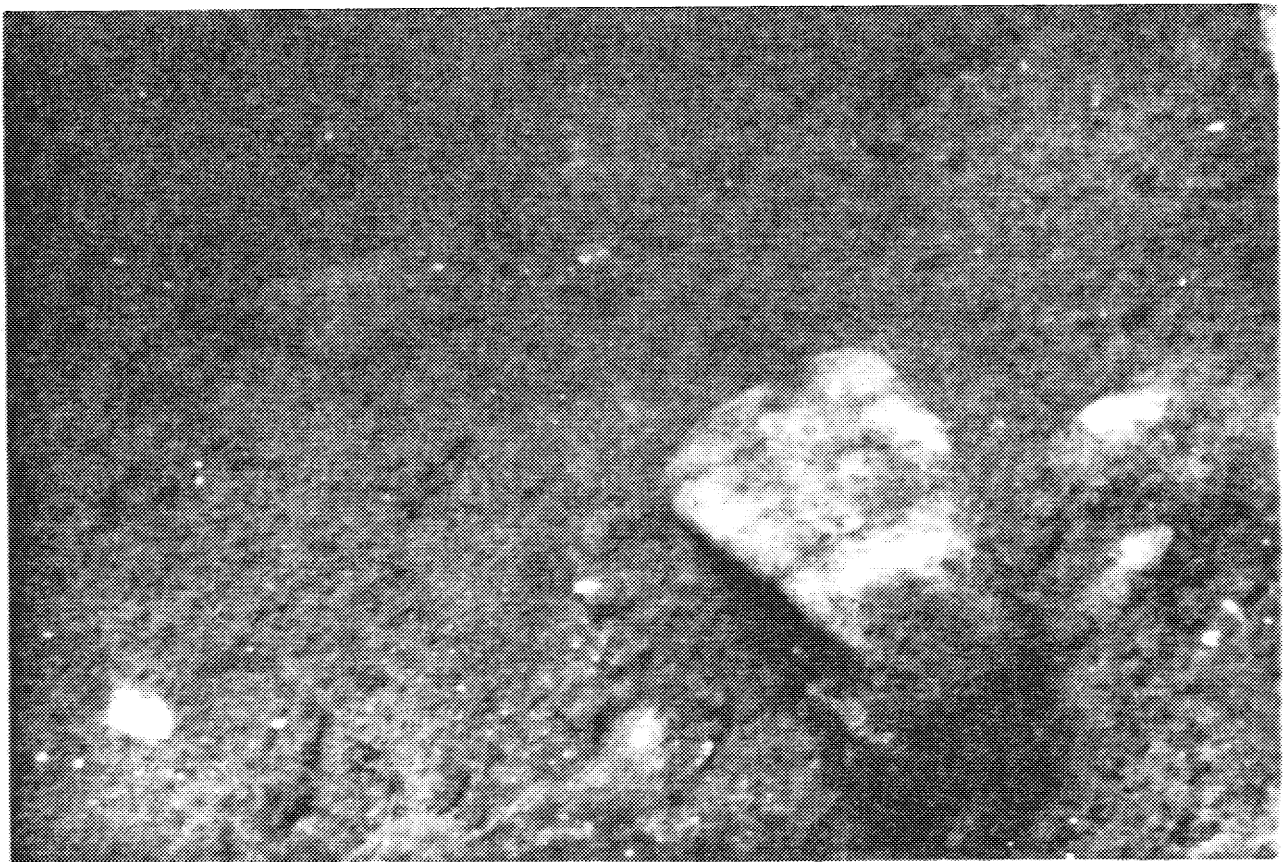


Figure 3.0-4d Denuded hydroid stalk (Tubularia) with associate epifauna caprellid amphipod (arrow).

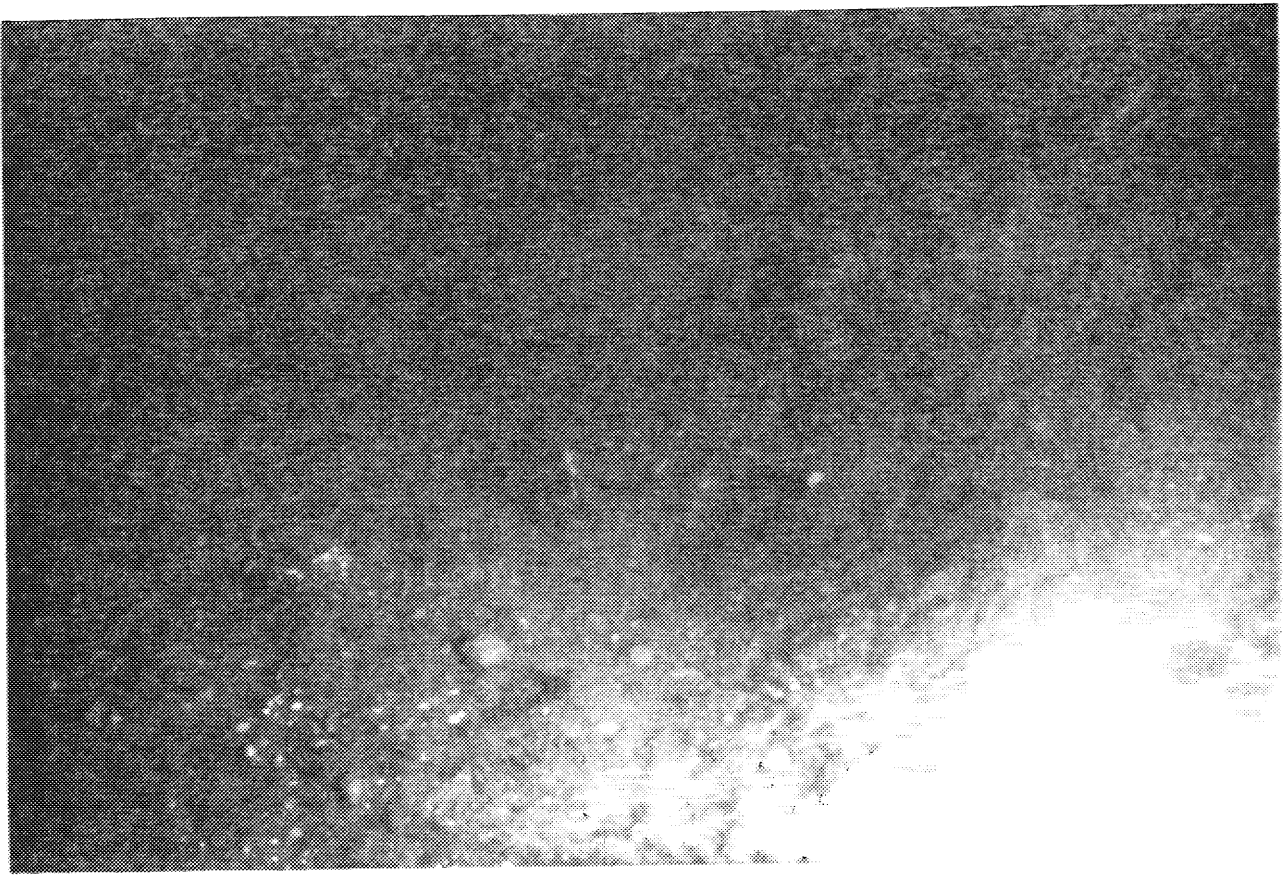


Figure 3.0-4e Mercenaria shell and numerous small vertical burrows indicated extensive sediment reworking.

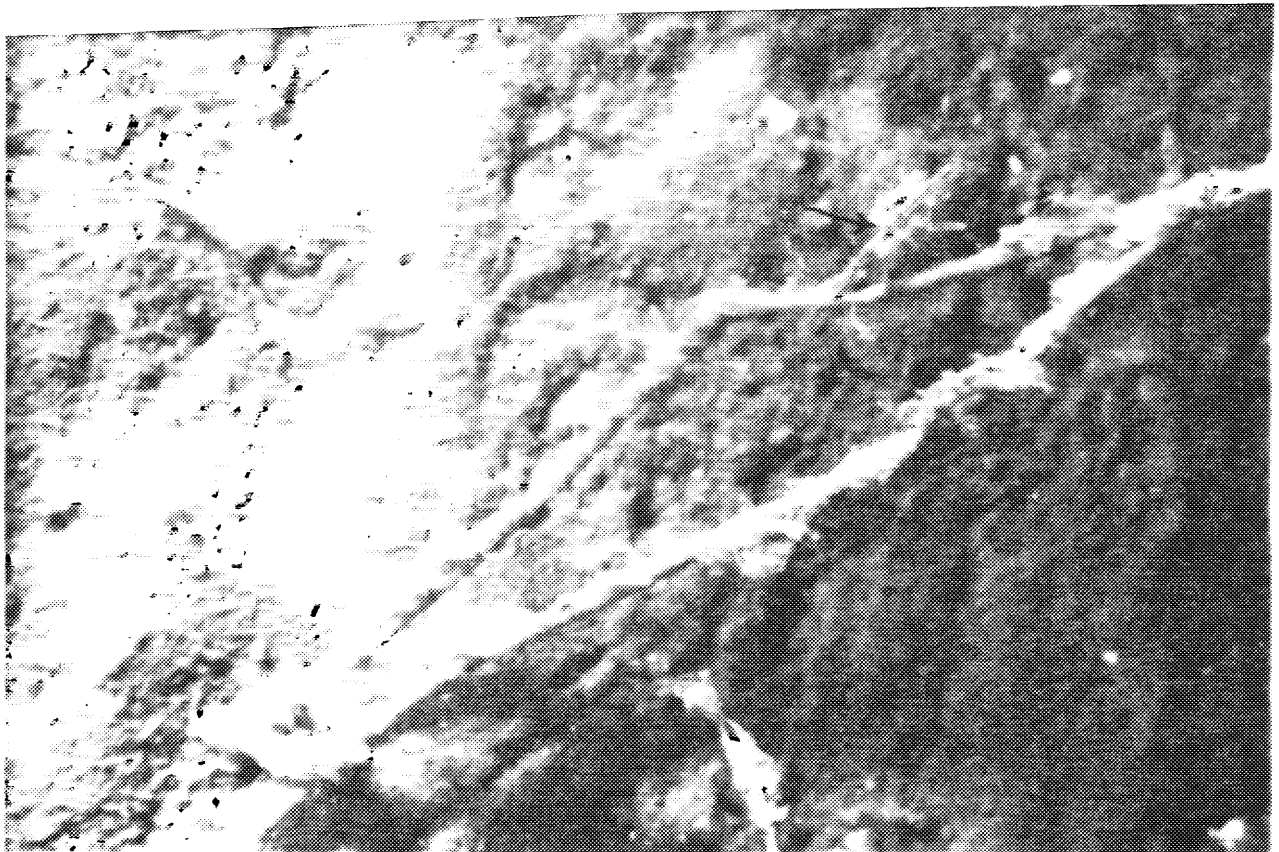


Figure 3.0-4f Cobble on sediment surface suggested recent turnover and new hydroid growth due to active bioturbation of surface substrate.



Figure 3.0-4g Alcove excavations on top of the historic spoil region revealed constant use by a wide range of species for shelter or food source.

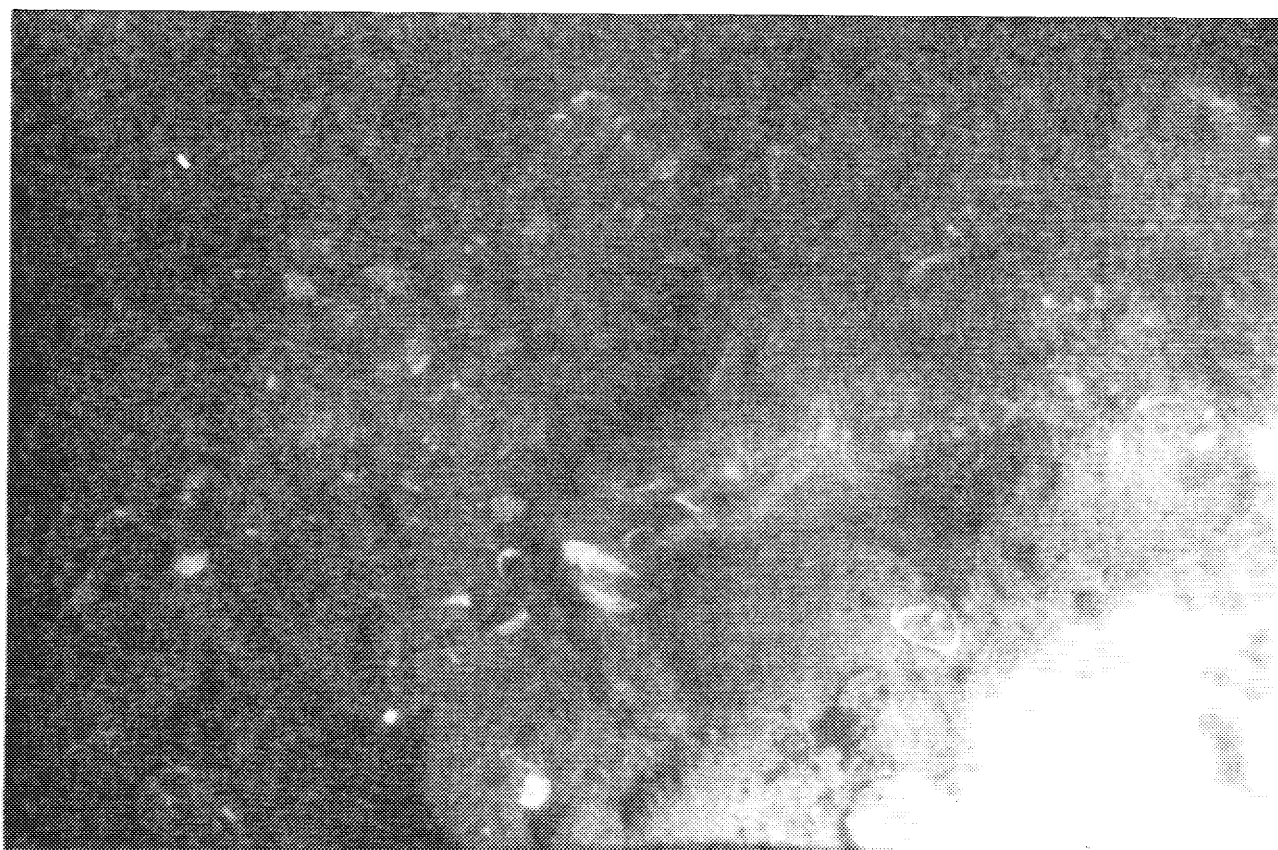


Figure 3.0-4h A rough post-spoil terrain was formed by exposed shellhash and a cobble/boulder substrate. Niche space illustrates attraction of the hake, Urophycis.

system were installed on the breakwater at the east entrance to the Cape Cod Canal at $41^{\circ} 46.779'N$, $70^{\circ} 29.425'W$ and on the Rock Harbor breakwater at Orleans at $41^{\circ} 47.95'N$, $70^{\circ} 00.55'W$.

On 12 August, a bathymetric survey (Figure 4.0-1) was run over the same tracks as the baseline survey conducted on 2 December 1980 (Figure 4.0-2). A comparison of these two charts indicates a general shoaling of the center portion of the area by as much as 1.5 meters. However, no distinct dredge material mound is present in spite of the point dumping procedures used during the disposal operation. The overall shoaling of the site and the random distribution of small closed contour lines throughout the site indicate that the material is spread over a large area. Representative fathometer traces across the disposal site (Figure 4.0-3 & 4.0-4) indicate clearly that the spoils are present but not concentrated in a mound. It is interesting that lane 13, located at the disposal buoy has very little build up of material, while lane 11, 50 meters west of the dump site has thicker deposits. Such a distribution suggests that the disposal scows were probably moving westward when the dumping occurred. Even if this were the case, however, development of a more extensive mound would be expected.

There are indications that such a mound did exist at one time. Communications with Mr. Frank Germano of the Massachusetts Department of Fisheries revealed that a mound approximately 3-4 meters thick was observed at the site immediately after disposal. However, this area is heavily fished and discussions with fishermen suggest that the mound was leveled and dispersed by towing of nets through the site. The spread of

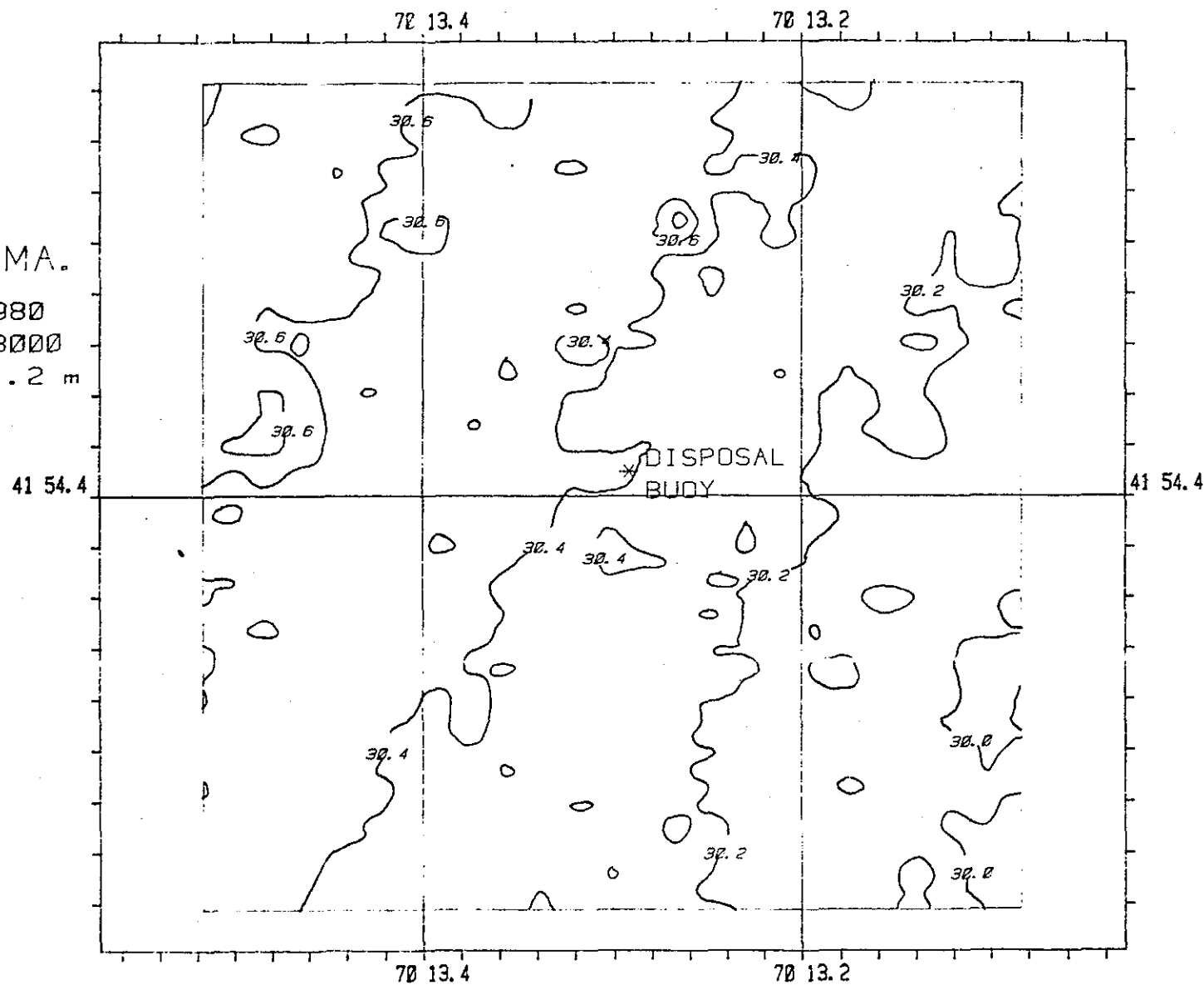


Fig. 4.0-2

BATHYMETRIC PROFILE
LANE 11
WELLFLEET DISPOSAL SITE
AUGUST, 1981

40'

50'

60'

70'

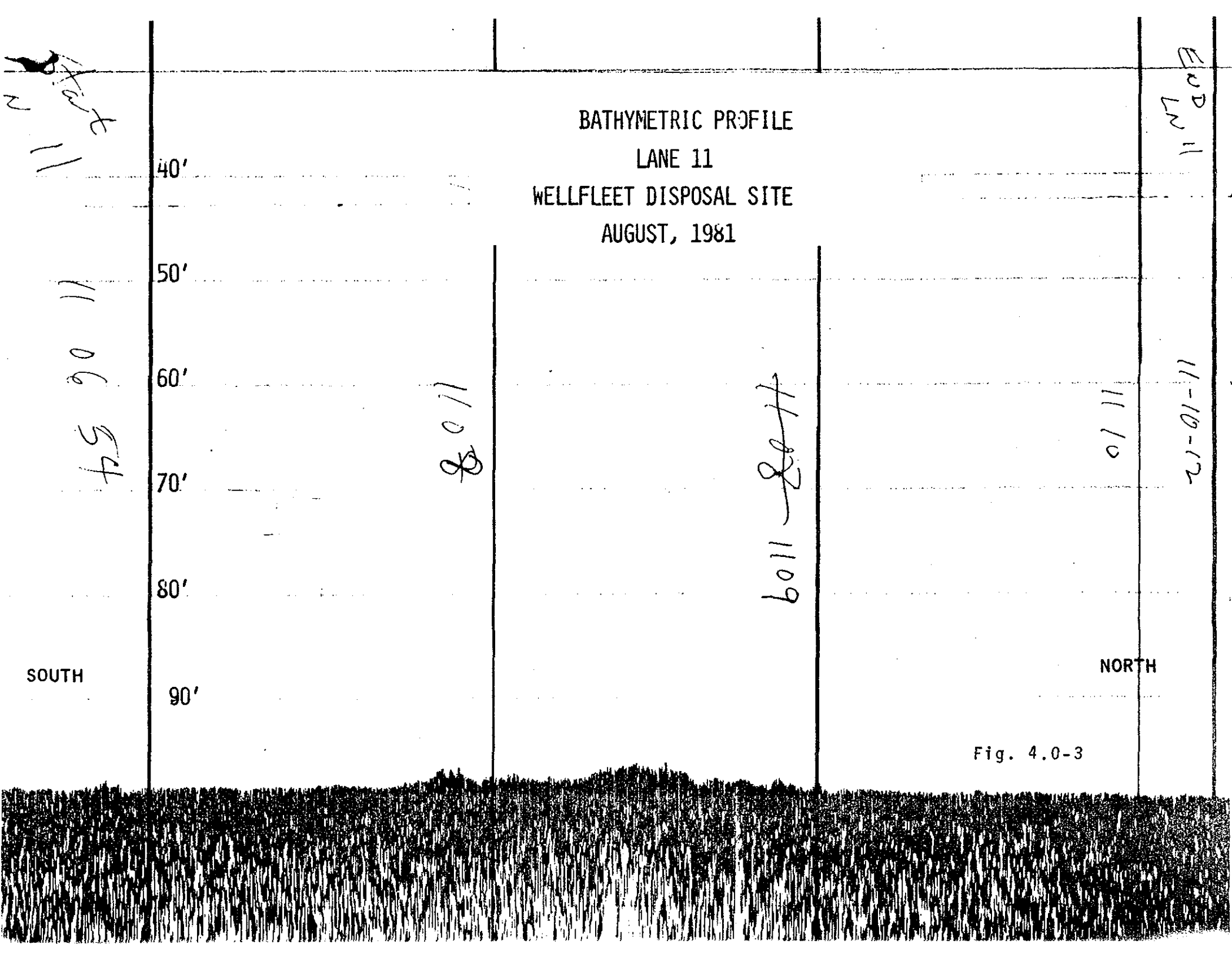
80'

90'

SOUTH

NORTH

Fig. 4.0-3



BATHYMETRIC PROFILE
LANE 13
WELLFLEET DISPOSAL SITE
AUGUST, 1981

40'

50'

60'

70'

80'

90'

SOUTH

NORTH

Fig. 4.0-4

END LN 13

112114

1121

11-20

Buoy

11-18-00
11-18-00
11-18-00

material and the random distribution of contours within the survey area both point to leveling of the mound in this manner. At other sites where erosion of the mound has occurred through natural processes, the dredged material was completely removed from the site and no spreading of material within the site has been observed.

This spreading of material has several significant impacts on assessing the environmental consequences of the disposal operation. First, calculation of volume difference using normal DAMOS procedures is impossible since the assumption of no changes in depth at the margins of the survey is no longer valid. Second, reduction of the surface area of dredged material through creation of a mound has not been maintained and much more material is exposed for interaction with the benthic biota and the water column. Third, intermixing of dredged and natural sediment will occur much more readily through benthic burrowing and physical interaction with the bottom boundary layer; consequently identification of material either through chemical or physical methods will be more difficult and assessment of spreading or other impacts more tenuous.

Following completion of the bathymetric survey, sediment samples were taken for chemical analysis and benthic biota investigations. All samples are now undergoing analysis and results will be provided as they become available. The locations and types of samples obtained are presented in Table 4.0-1 and Figure 4.0-5. Five replicates were taken for biological investigations at the center of the site, at the outer edge of dredged material on natural bottom 250 m east of the center, and

CHEMISTRY SAMPLES

<u>SAMPLE</u>	<u>LATITUDE</u>	<u>LONGITUDE</u>	<u>NUMBER</u>	<u>TYPE</u>
WF-CTR-A	41°54.399'	70°13.299'	1240	GS
WF-CTR-A			1241	HM
WF-CTR-A			1242	HM
WF-CTR-B			1243	HM
WF-CTR-C			1244	HM
WF-REF-A	41°54.400'	70°12.578'	1245	GS
WF-REF-A			1246	HM
WF-REF-B			1247	HM
WF-REF-C			1258	HM
WF-100E-A	41°54.000'	70°13.228'	1249	GS
WF-100E-A			1250	HM
WF-100E-B			1251	HM
WF-100E-C			1252	HM
WF-200E-A	41°54.400'	70°13.156	1253	GS
WF-200E-A			1254	HM
WF-200E-B			1255	HM
WF-200E-C			1256	HM
WF-100N-A	41°54.454'	70°13.299'	1257	GS
WF-100N-A			1258	HM
WF-100N-B			1259	HM
WF-100N-C			1260	HM
WF-250N-A	41°54.535'	70°13.299	1261	GS
WF-250N-A			1262	HM
WF-250N-B			1263	HM
WF-250N-C			1264	HM
WF-300W-A	41°54.400'	70°13.517'	1265	GS
WF-300W-A			1266	HM
WF-300W-B			1267	HM
WF-300W-C			1268	HM
WF-400W-A	41°54.400	70°13.589	1269	GS
WF-400W-A			1270	HM
WF-400W-B			1271	HM
WF-400W-C			1272	HM
WF-300S-A	41°54.238'	70°13.299'	1303	GS
WF-300S-A			1304	HM
WF-300S-B			1305	HM
WF-300S-C			1306	HM
WF-500S-A	41°54.130	70°13.299	1307	GS
WF-500S-A			1308	HM
WF-500S-B			1309	HM
WF-500S-C			1310	HM

Table 4.0-1. Sediment Sample Locations
Wellfleet Disposal Site
August 1981

BIOLOGICAL SAMPLES

WF-CTR-1	41°54.399	70°13.299	1273	GS
WF-CTR-1			1274	HM
WF-CTR-2			1275	GS
WF-CTR-2			1276	HM
WF-CTR-3			1277	GS
WF-CTR-3			1278	HM
WF-CTR-4			1279	GS
WF-CTR-4			1280	HM
WF-CTR-5			1281	GS
WF-CTR-5			1282	HM
WF-250E-1	41°54.400'	70°13.119	1283	GS
WF-250E-1			1284	HM
WF-250E-2			1285	GS
WF-250E-2			1286	HM
WF-250E-3			1287	GS
WF-250E-3			1288	HM
WF-250E-4			1289	GS
WF-250E-4			1290	HM
WF-250E-5			1291	GS
WF-250E-5			1292	HM
WF-REF-1	41°54.400	70°12.578	1293	GS
WF-REF-1			1294	HM
WF-REF-2			1295	GS
WF-REF-2			1296	HM
WF-REF-2			1297	GS
WF-REF-3			1289	HM
WF-REF-4			1299	GS
WF-REF-4			1300	HM
WF-REF-5			1301	GS
WF-REF-5			1302	HM

TABLE 4.0-1 (continued)

WELLFLEET SEDIMENT SAMPLES

CHART SCALE: 1/6000

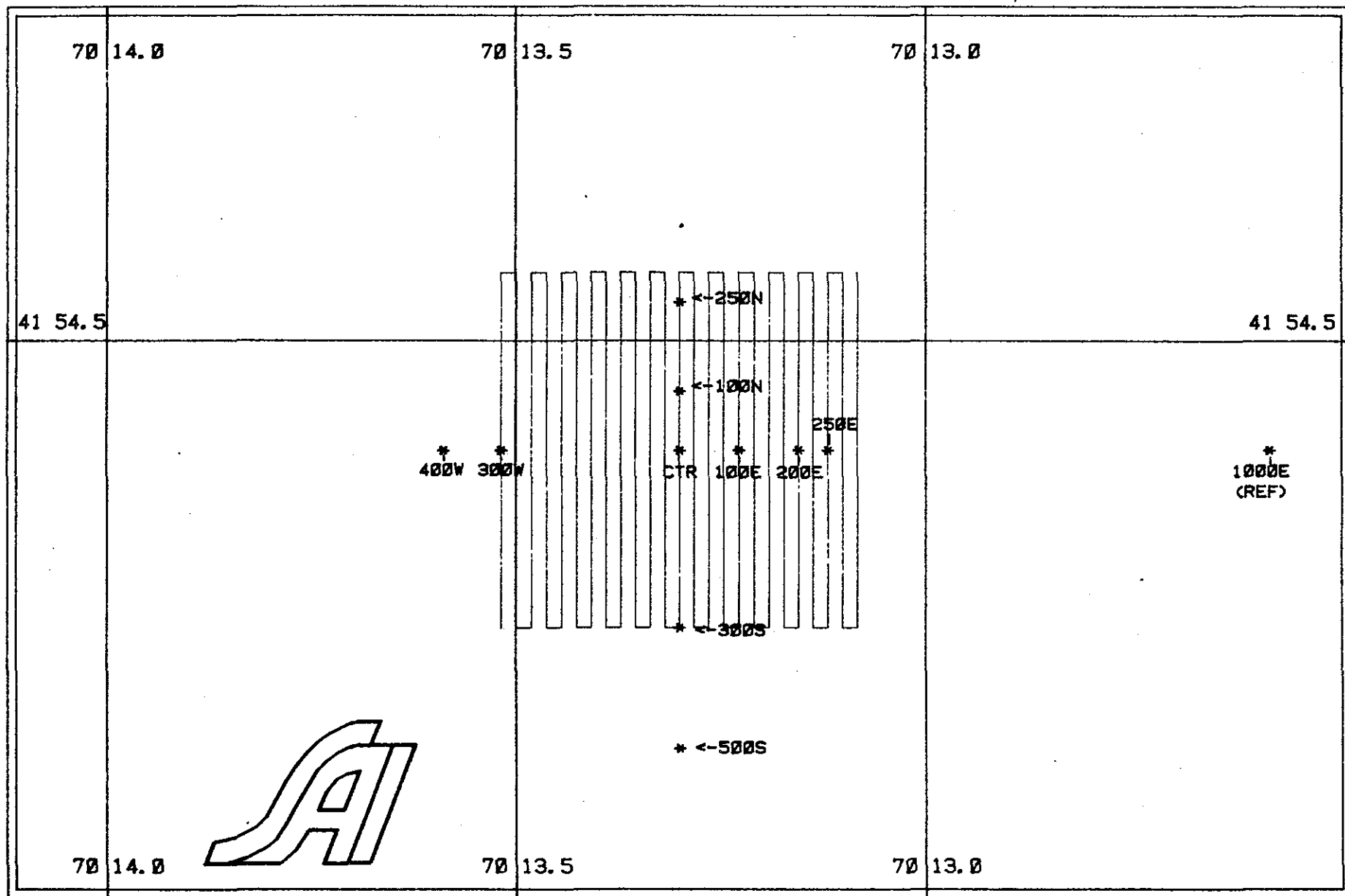


Fig. 4.0-5

at a reference site located 1000 m east of the disposal buoy. Three replicates were taken for chemical analysis at stations located on the outer margins of the spoil and on natural bottom immediately adjacent to the spoil in the north, east and west directions.

Sediment samples taken at the center of the site consisted of approximately 3 mm of oxidized silt overlaying a 4 cm layer of coarse sand. Also present were deposits of black organic silt intermixed with gray clay indicative of dredge spoil. Grabs at the reference site were composed of fine oxidized silt accompanied by worm tubes indicative of natural bottom. Samples 100 m east of the dump site buoy contained an 8-10 cm layer of spoil similar to the center samples overlaying natural bottom. At 250 m east of the buoy, the bottom was essentially natural with just a thin veneer of black organic dredged material. To the north of the buoy, samples contained a gradually thinning layer of spoil out to a point 250 m north where natural bottom resumed. The western edge of the spoil was located 400 m west of the buoy and consisted of deposits of coarse sand mixed with the natural bottom.

Visual observations were made at the site by divers swimming a transect approximately 300 m east of the disposal buoy. At this site, the bottom was essentially flat consisting of coarse sand in a silty matrix. Topographic relief on the order of 1 - 2 meters was observed in patches over the area indicative of either individual disposal scow loads or material spread by trawl nets.

A high degree of large scale bioturbation was observed on the coarse sand surface (i.e. .5 m diam. Urophysis

excavation, 1 m lobster burrows, .5 m wolf eel burrow, several 10 cm conical mounds with vertical burrows). Shell fragments (oyster, scallop, etc) formed patches of shell hash.

Biological observations indicated a well developed macrobenthic population consisting of the following organisms:

- Fish:
Wolf eel Anarhichas lupus
Hake Urophycis
- Crustacea:
Cancer borealis (5)
Cancer irroratur (3)
Mysids 8sp) (ubiquitous)
Cerianthus (7)
Crangon (100+)
- Other:
Asterias (6)
Amphipod (clusters in depressions) (1000+)
Isopods (individuals on sediment surface) (2)
Polychaete worm tubes and fragments (50)
Flatworms (50+) Platyhelminthus (on sediment surface)

In-situ photographs taken during the dive are presented in Figure 4.0-6(a-o).

5.0 NORWALK

After completion of the surveys at the Brenton Reef and Wellfleet disposal sites, all equipment was transferred to the R/V UCONN and surveys at the Norwalk Disposal Site in Central Long Island Sound were conducted during the week of 17 August 1981. As at the previous sites, monitoring consisted of a bathymetric survey, sediment sampling for biological and chemical analysis, water sampling and diver observations.

The shore station locations used to provide navigation control with the SAI Navigation and Data Acquisition System were Lighthouse Point, New Haven at 41° 14.93'N, 72°

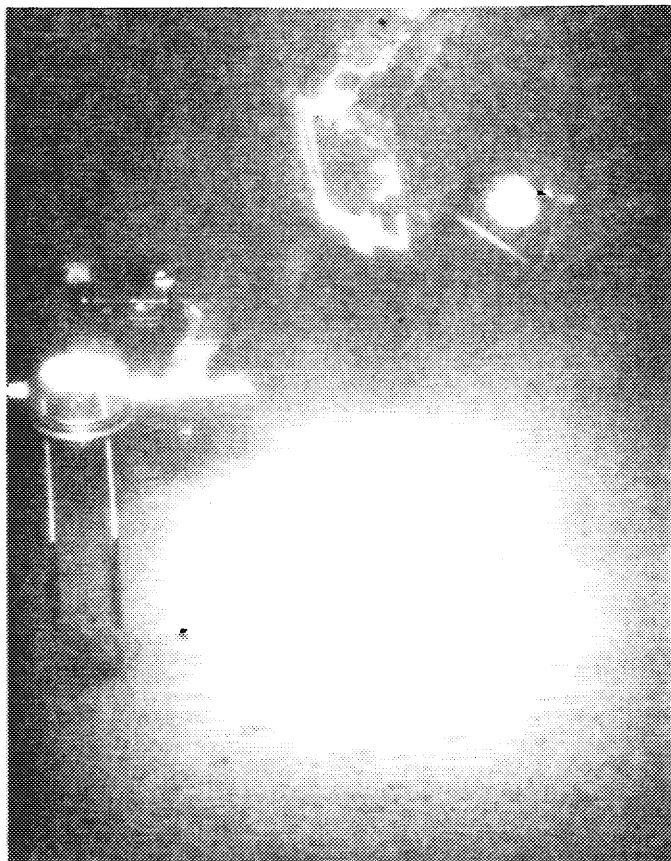


Figure 4.0-6a Diver conducting macrophotography along eastern transect.



Figure 4.0-6b Surface sediment granular detail surrounding the burrowing anemone Cerianthus americanus.

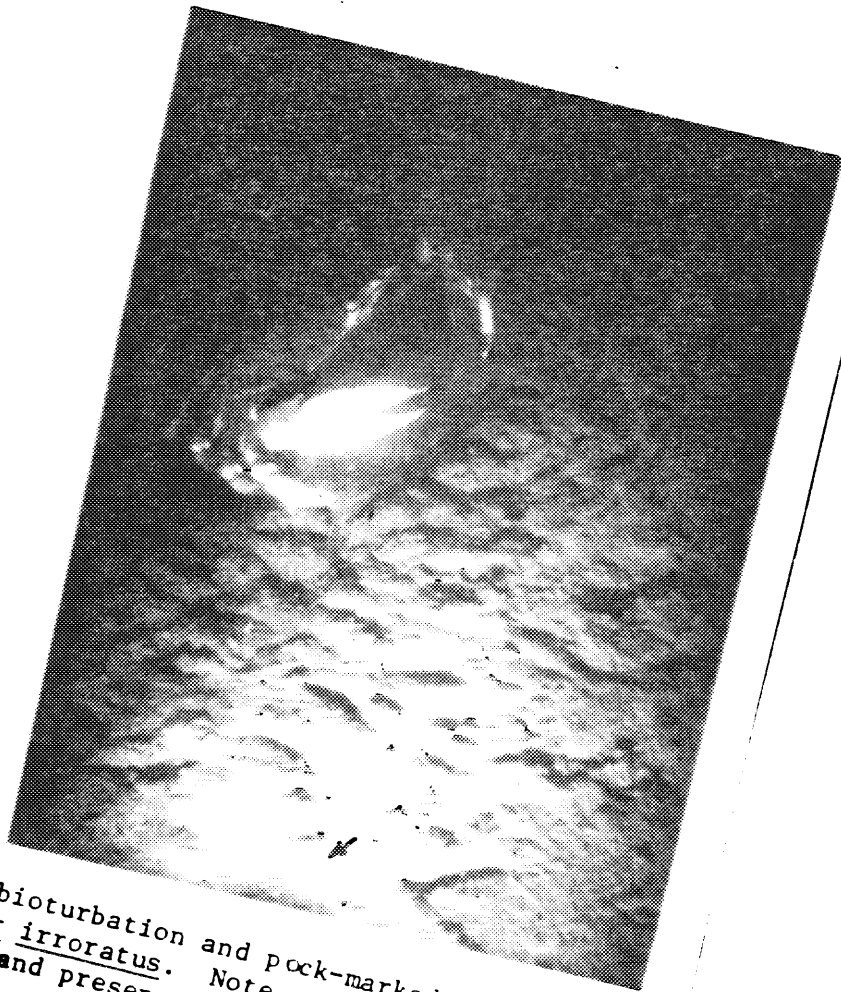
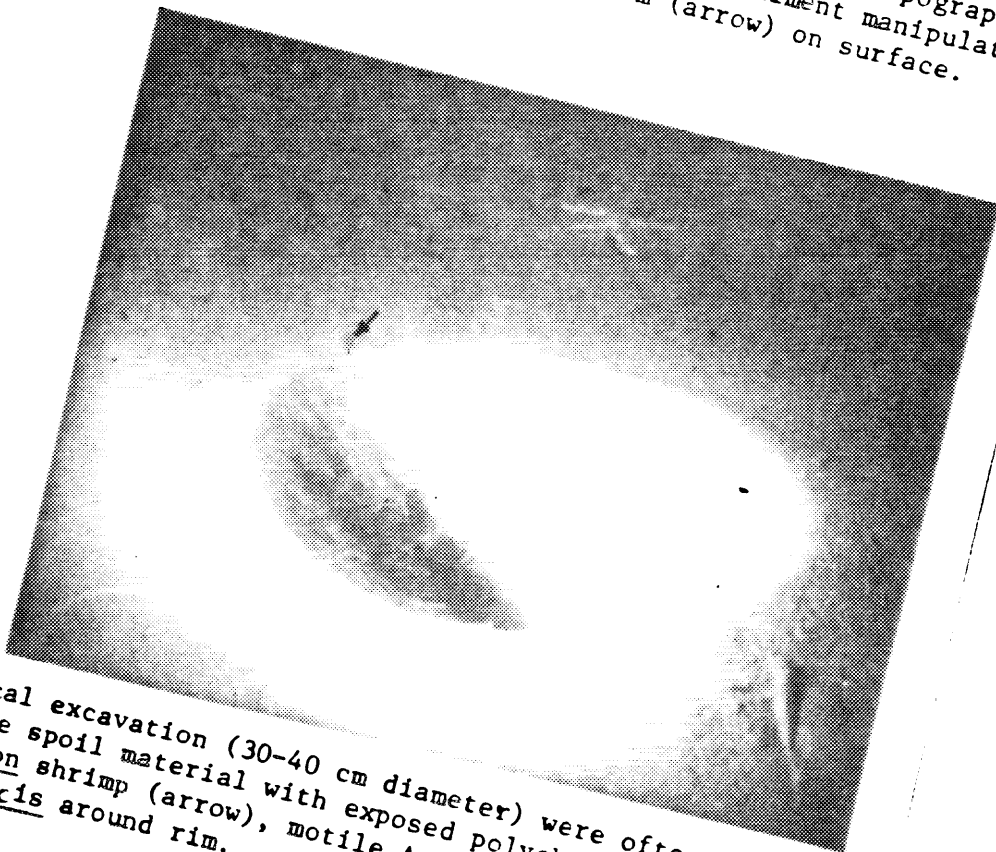


Figure 4.0-6c Surface bioturbation and pock-marked sediment topography created by Cancer irroratus. Note extensive sediment manipulation (1-2 cm) and presence of flatworm (arrow) on surface.



Artificial excavations (30-40 cm diameter) were often noted on the surface. Spoil material with exposed polychaete worm tubes, shrimp (arrow), motile Asterias, and juvenile fish were often noted around rim.



Figure 4.0-6e Structural features along crest of conical excavation (burrow depressions, small (1 cm diam vertical burrows, mollusk tracks) indicate intense biological activity.

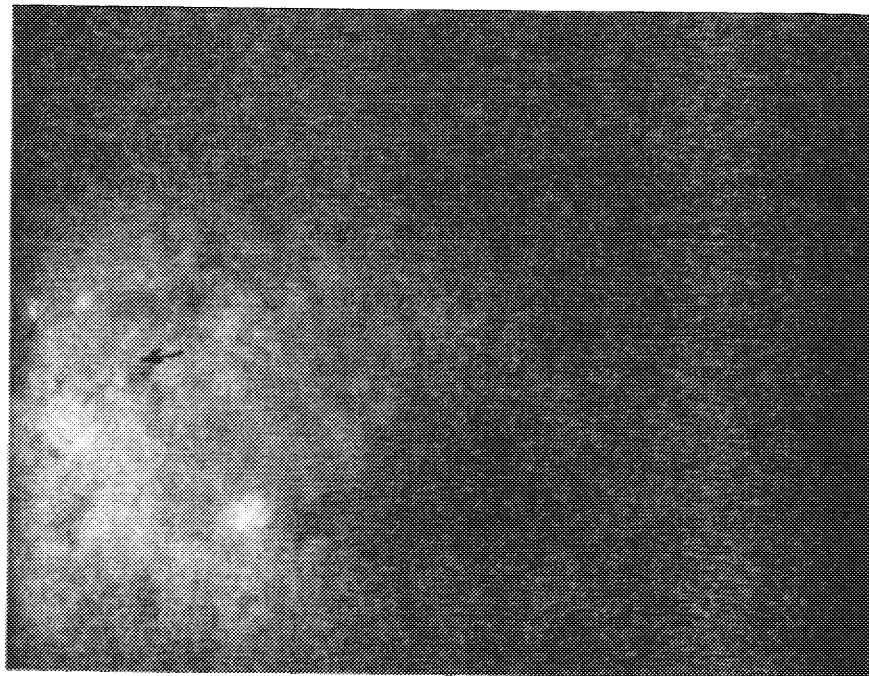


Figure 4.0-6f Burrows of various diameters (20 - 1 cm) indicated, a wide range of species utilized the natural bottom immediately adjacent to new spoil material. Evidence of Corymorpha pendula (arrow) clusters were encountered along the western transect.

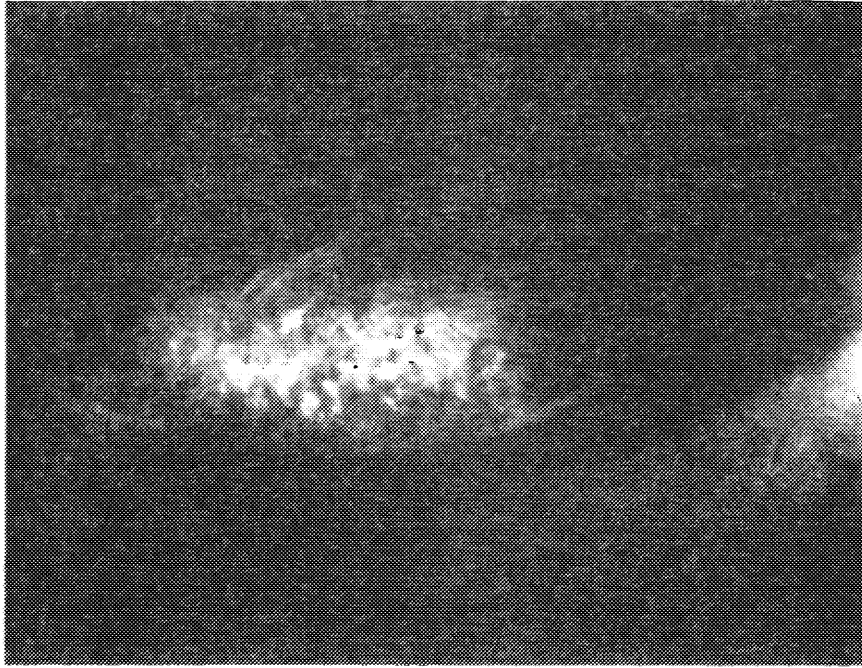


Figure 4.0-6g Large hake Urophycis were observed residing in large conical depressions.

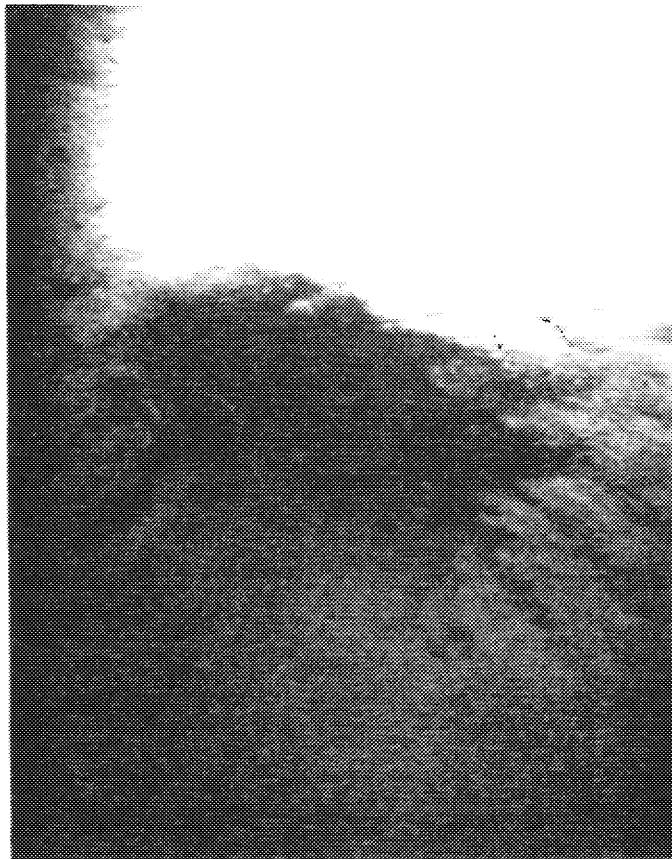


Figure 4.0-6h Burrow construction along slope contours was more common with cohesive material maintaining structure shape.

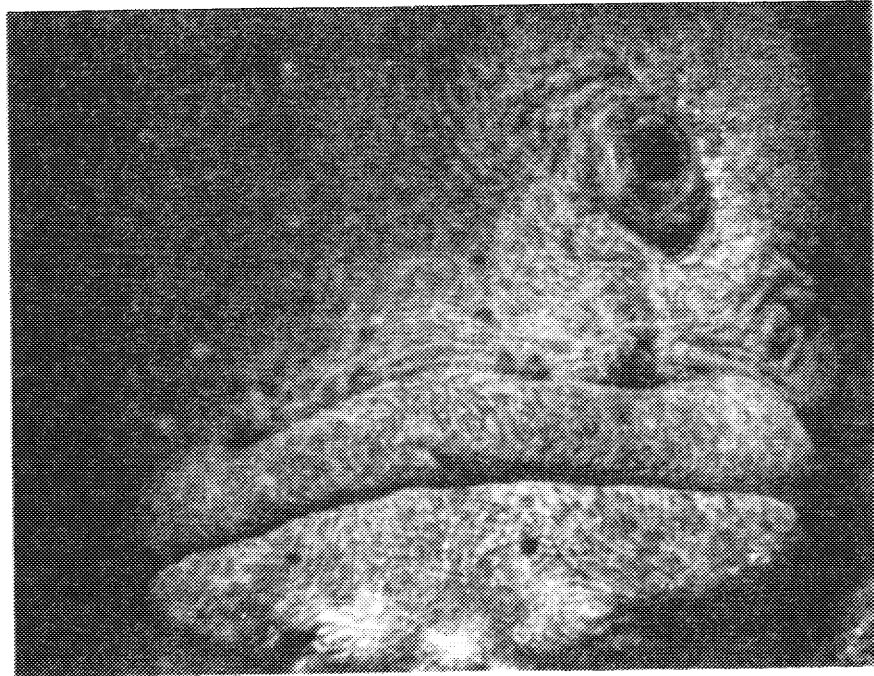


Figure 4.0-6i A juvenile wolf fish Anarhichas was observed within a 1 m mud burrow .



Figure 4.0-6j Clay mound material was less common but equally inhabited by burrow dwelling biota.

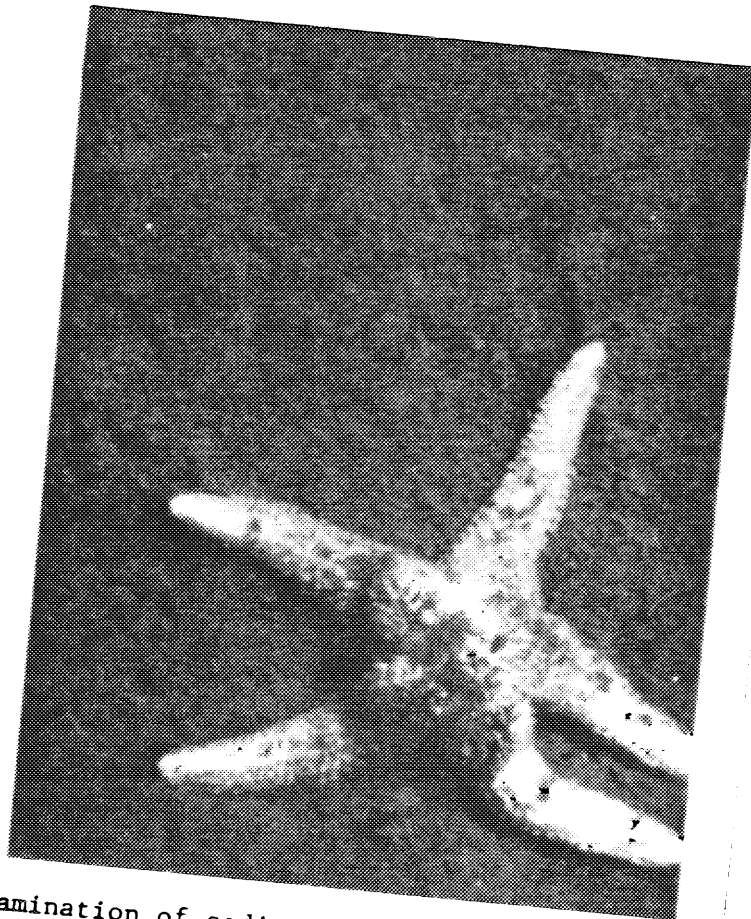


Figure 4.0-6k Close examination of sediment surfaces revealed a fecal pellet texture with small spherical sediment balls. (Note Asterias prey posture and isopod in upper left).

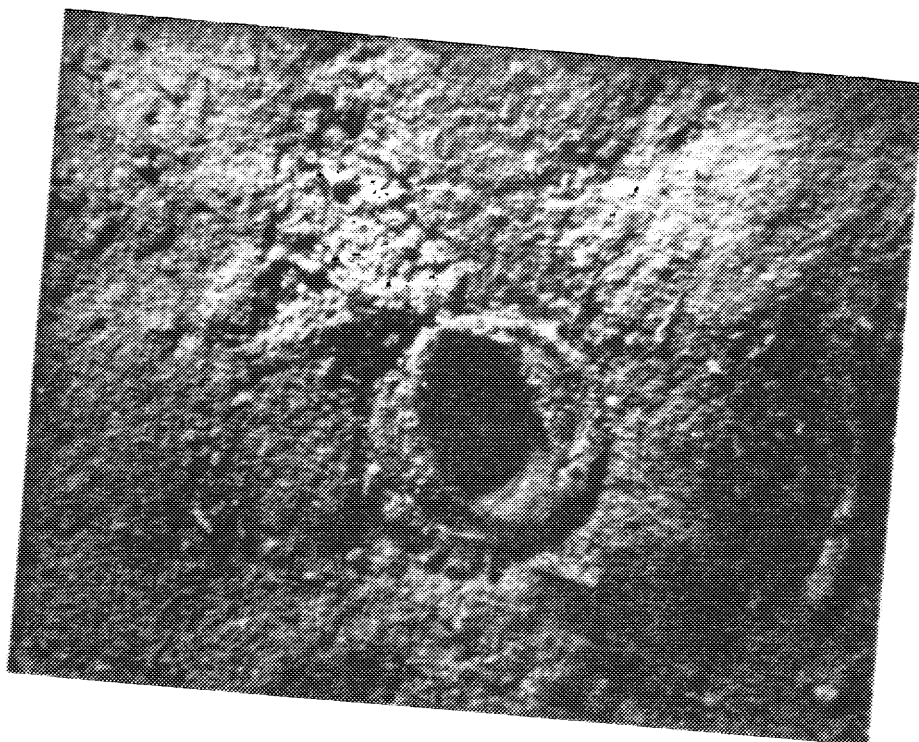


Figure 4.0-6l The burrow tube of a retracted Cerianthus with polycheate tubes and Pectinaria cast to right.

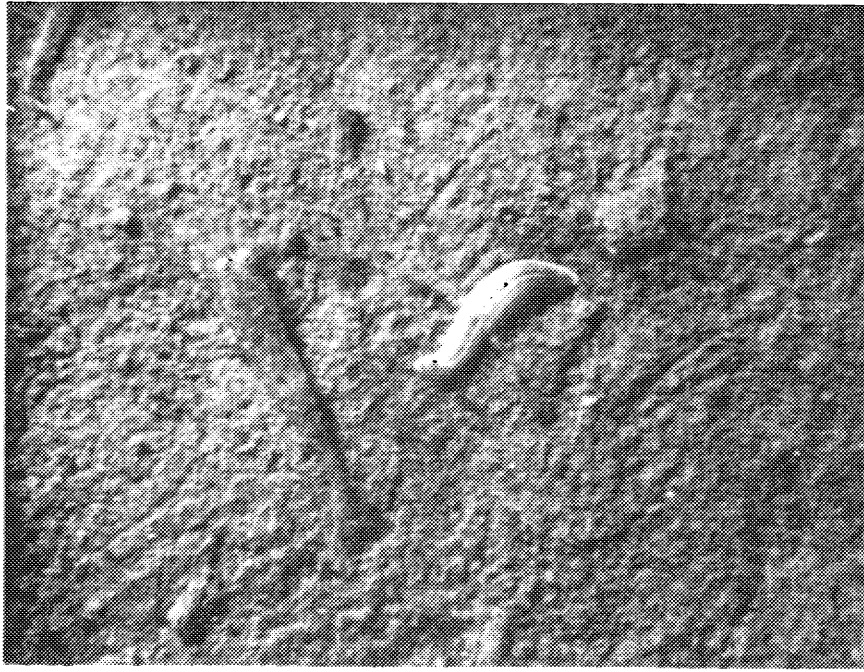


Figure 4.0-6m Common epibenthic feeding organisms - Crangon and large (2 cm) platyhelminthes were routinely noted along both transects.

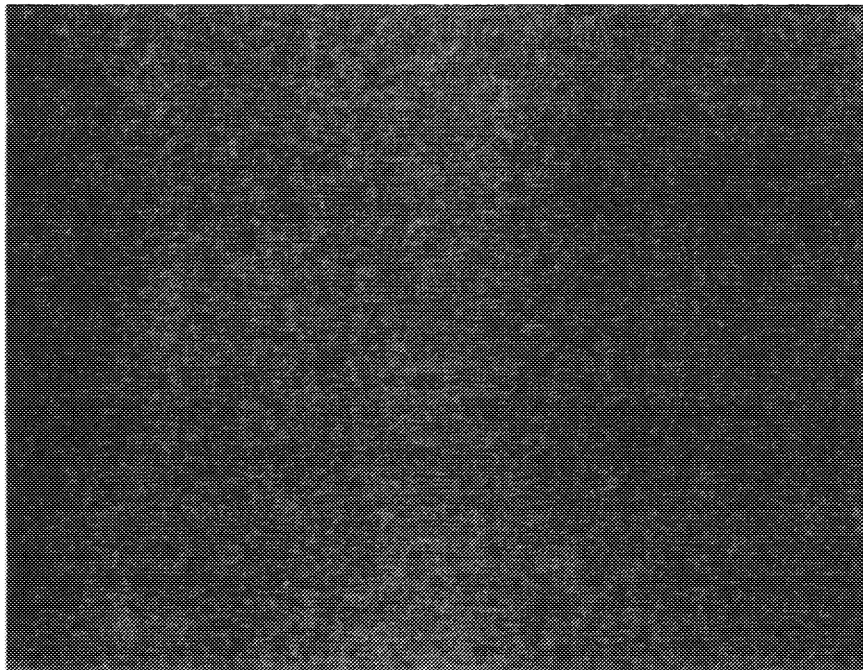


Figure 4.0-6n A mass concentration of amphipods was sighted within a sediment depression zone.

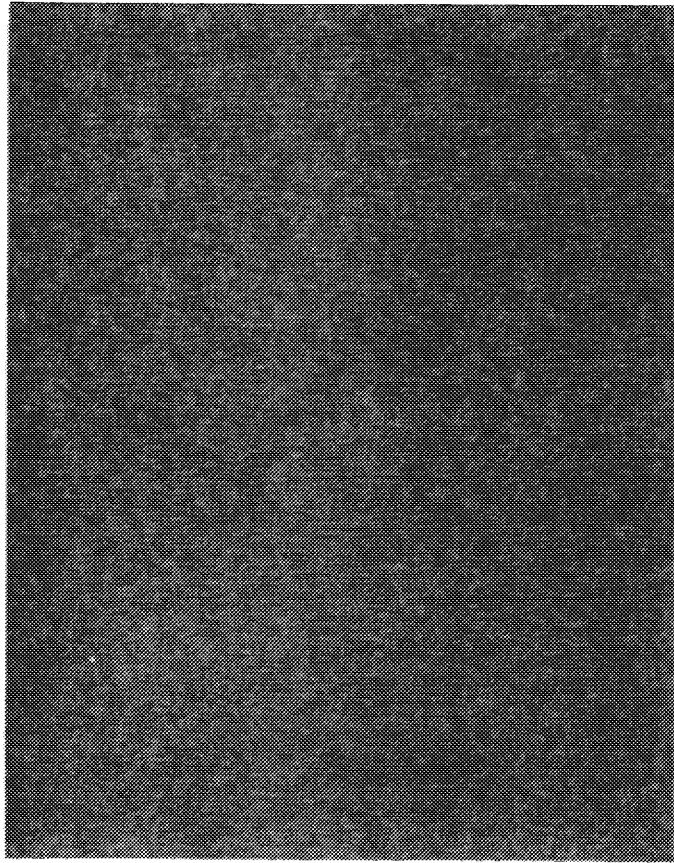


Figure 4.0-60 The solitary stalked hydroid, Corymorpha pendula on finer grained soft mud natural substrate.

54.25'W and Stratford Point at 41° 09.14'N, 73° 06.26'W. On 19 August, a bathymetric survey was run over the same course tracks used on previous surveys during 1980 and 1981. Figure 5.0-1 is a contour chart of the latest survey made on 28 April 1981. A significant result of that survey was the discovery of dredged material extending west of the disposal point and the presence of two mounds north and south of the disposal buoy.

Figure 5.0-2 is a contour chart of the August 19 survey which indicates several significant points. Most important of these, the south mound has remained essentially stable since the previous survey with a minimum depth slightly deeper than 15 meters. Figure 5.0-3 is a volume difference calculation indicating the addition of approximately 125,000 m³ of material between April and June 1981. The contour difference chart (Figure 5.0-4) indicates that disposal since April has been much better controlled as the north mound has built up to a depth similar to the south mound, but no additional material has been added to the west. If further dumping is expected at this site, the disposal point should be changed to keep the minimum depth from becoming more shallow.

Sediment samples were obtained for chemical analysis and benthic identification at the locations shown in Figure 5.0-5 and listed in Table 5.0-1. Ten replicates were taken at each of four biological stations designated as the center of the mound, the inner edge (300 E), the outer edge (450 E) and the reference station. Three replicates were obtained at the remaining chemical stations located at the inner and outer edges in the north, south and west directions.

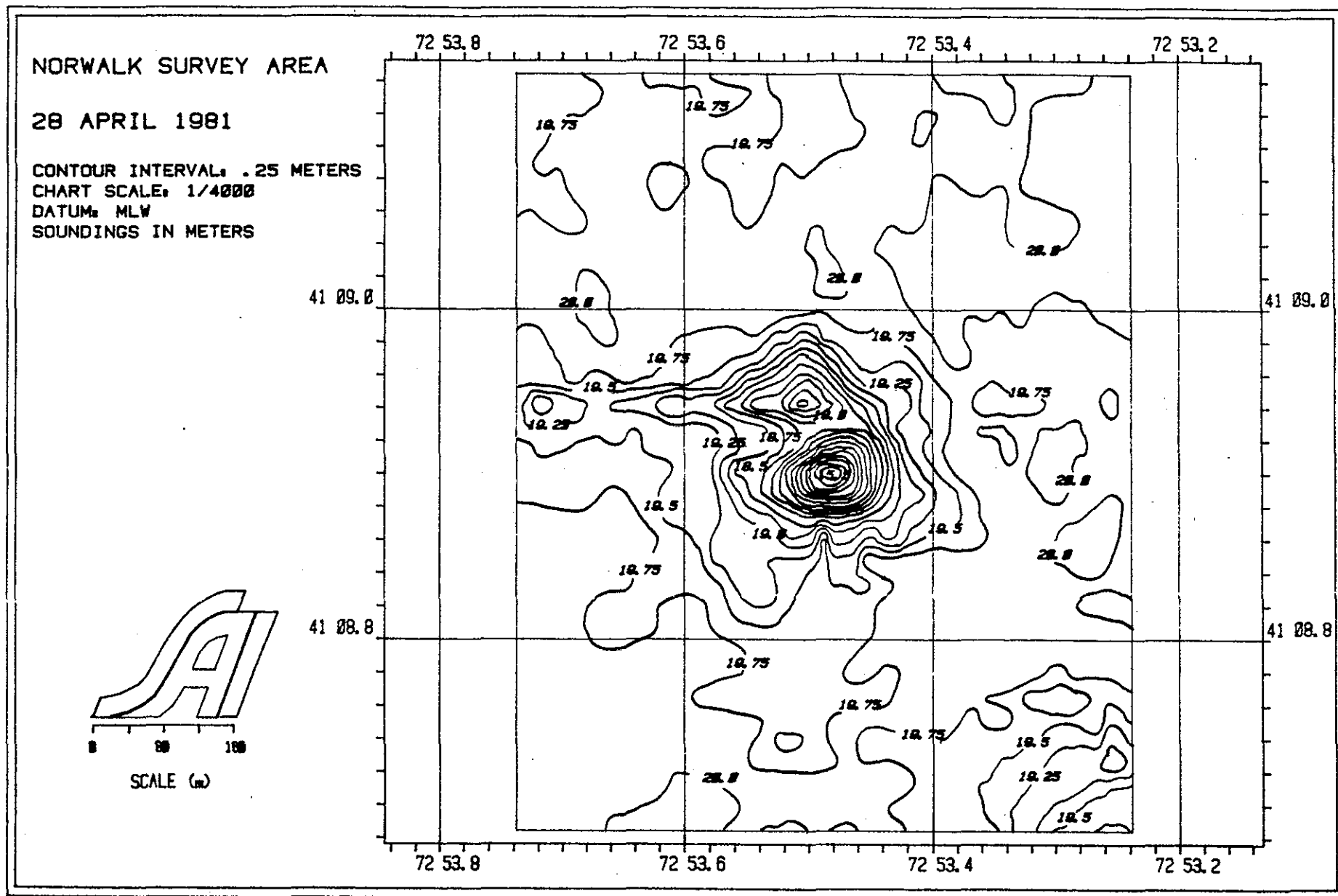


Fig. 5.0-1

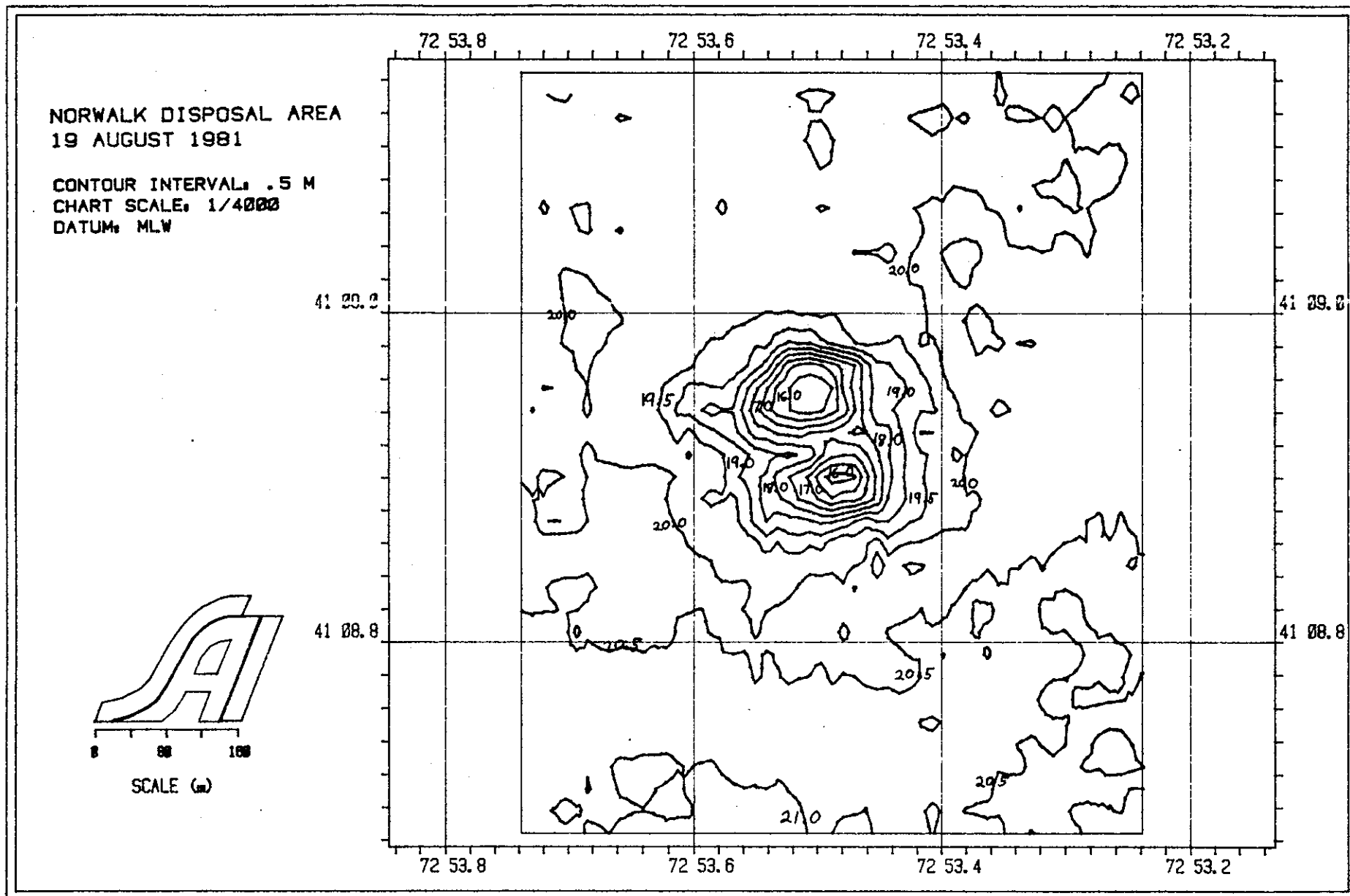


Figure 5.0-2

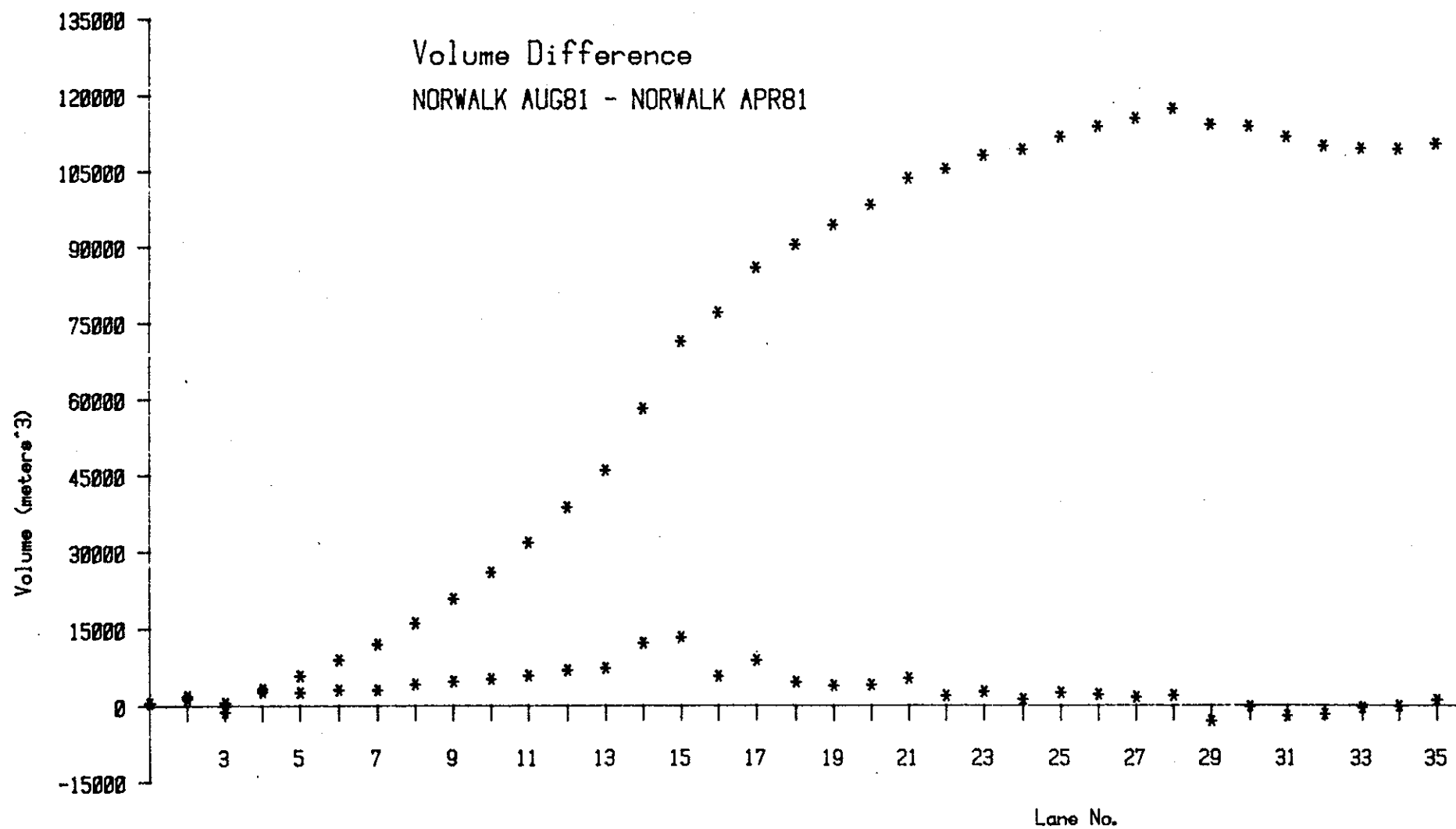


Fig. 5.0-3

CHART SCALE - 1/4000

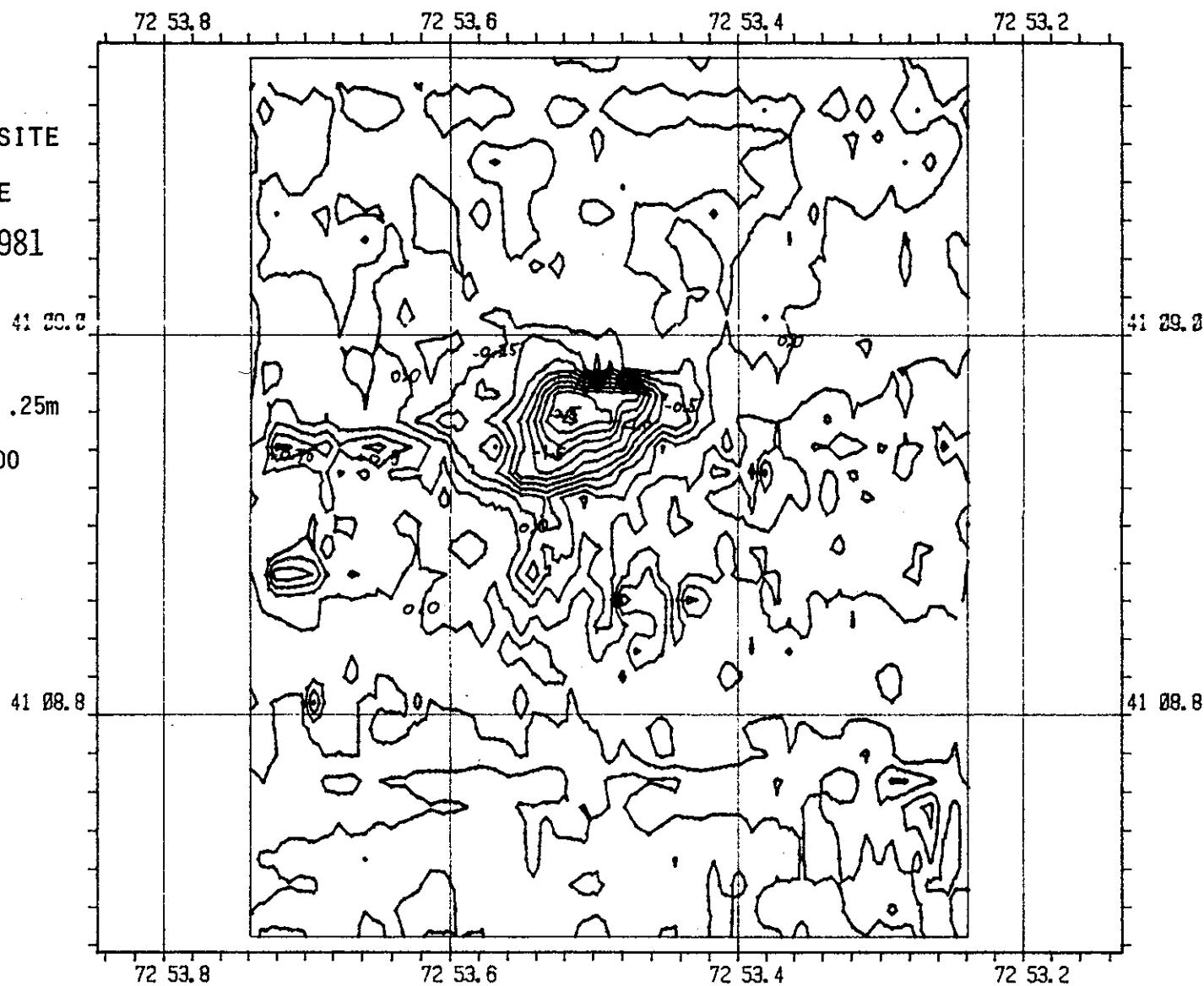


Fig. 5.0-4

NORWALK AUG81 SEDIMENT SAMPLES

CHART SCALE: 1/ 4000

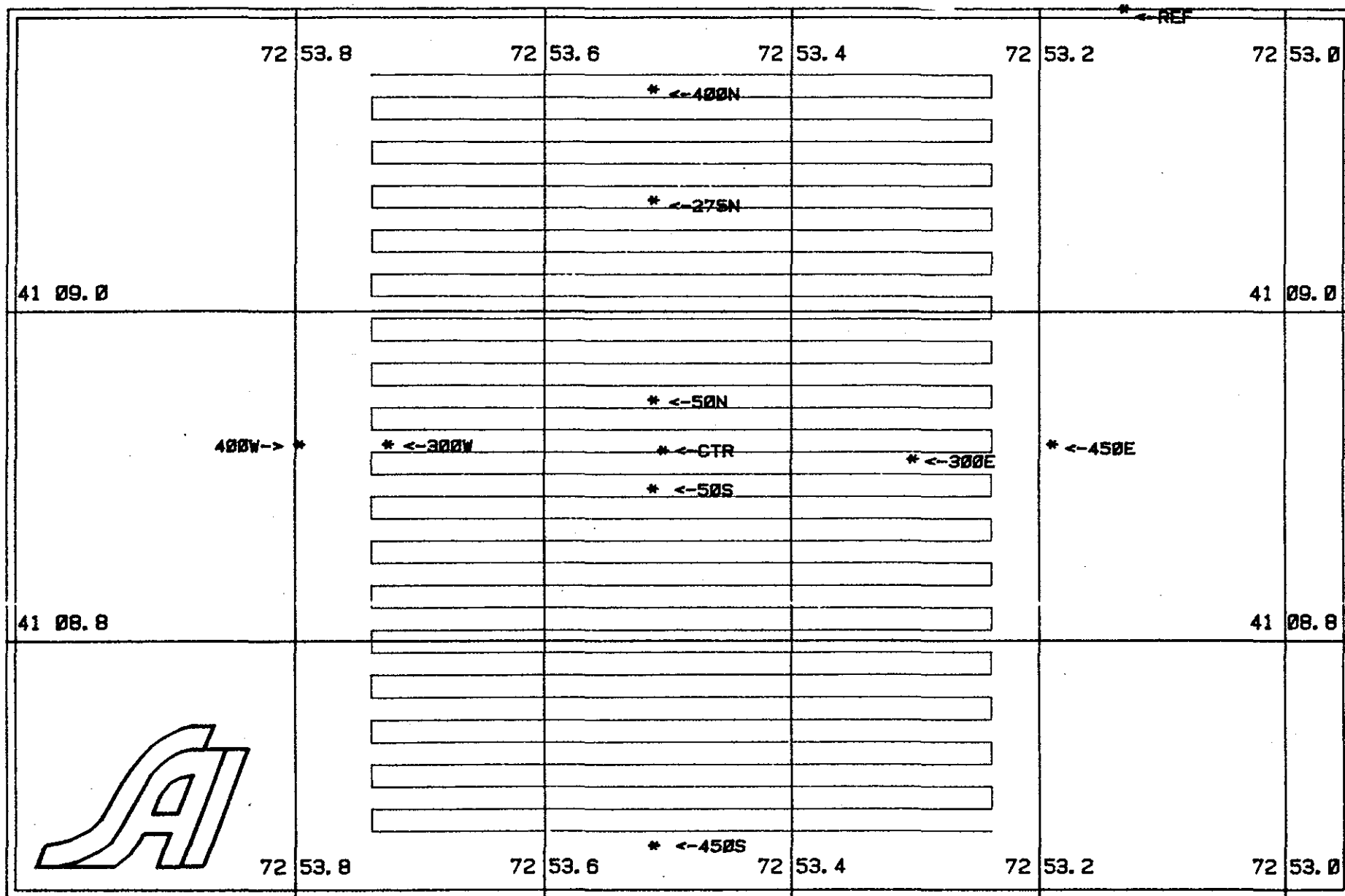


Fig. 5.0-5

<u>SAMPLE</u>	<u>LATITUDE</u>	<u>LONGITUDE</u>	<u>NUMBER</u>	<u>TYPE</u>
NOR-REF-1	41°07.948'	72°52.738'	1311	GS
NOR-REF-1			1312	HM
NOR-REF-2			1313	GS
NOR-REF-2			1314	HM
NOR-REF-3			1315	GS
NOR-REF-3			1316	HM
NOR-REF-4			1317	GS
NOR-REF-4			1318	HM
NOR-REF-5			1319	GS
NOR-REF-5			1320	HM
NOR-REF-6			1321	GS
NOR-REF-6			1322	HM
NOR-REF-7			1323	GS
NOR-REF-7			1324	HM
NOR-REF-8			1325	GS
NOR-REF-8			1326	HM
NOR-REF-9			1327	GS
NOR-REF-9			1328	HM
NOR-REF-10			1329	GS
NOR-REF-10			1330	HM
NOR-REF-11			1331	GS
NOR-REF-11			1332	HM
NOR-REF-12			1333	HM
NOR-REF-13			1334	HM
NOR-CTR-1	41°08.915'	72°53.503'	1335	GS
NOR-CTR-1			1336	HM
NOR-CTR-2			1337	GS
NOR-CTR-2			1338	HM
NOR-CTR-3			1339	GS
NOR-CTR-3			1340	HM
NOR-CTR-4			1341	GS
NOR-CTR-4			1342	HM
NOR-CTR-5			1343	GS
NOR-CTR-5			1344	HM
NOR-CTR-6			1345	GS
NOR-CTR-6			1346	HM
NOR-CTR-7			1347	GS
NOR-CTR-7			1348	HM
NOR-CTR-8			1349	GS
NOR-CTR-8			1350	HM
NOR-CTR-9			1351	GS
NOR-CTR-9			1352	HM
NOR-CTR-10			1353	GS
NOR-CTR-10			1354	HM
NOR-CTR-11			1355	GS
NOR-CTR-11			1356	HM
NOR-CTR-12			1357	HM
NOR-CTR-13			1358	HM

TABLE 5.0-1. Sediment Sample Locations
Norwalk Disposal Site
August 1981

<u>SAMPLE</u>	<u>LATITUDE</u>	<u>LONGITUDE</u>	<u>NUMBER</u>	<u>TYPE</u>
NOR-50N-A	41°08.946'	72°53.511'	1359	GS
NOR-50N-A			1360	HM
NOR-50N-B			1361	HM
NOR-50N-C			1362	HM
NOR-50S-A	41°08.892'	72°53.511'	1363	GS
NOR-50S-A			1365	HM
NOR-50S-B			1365	HM
NOR-50S-C			1366	HM
NOR-300E-A	41°08.919'	72°52.296'	1367	HM
NOR-300E-B			1368	GS
NOR-300E-B			1369	HM
NOR-300E-C			1370	HM
NOR-300E-1			1377	GS
NOR-300E-1			1378	HM
NOR-300E-2			1379	GS
NOR-300E-2			1380	HM
NOR-300E-3			1381	GS
NOR-300E-3			1382	HM
NOR-300E-4			1383	GS
NOR-300E-4			1384	HM
NOR-300E-5			1385	GS
NOR-300E-5			1386	HM
NOR-300E-6			1387	GS
NOR-300E-6			1388	HM
NOR-300E-7			1389	GS
NOR-300E-7			1390	HM
NOR-300E-8			1391	GS
NOR-300E-8			1392	HM
NOR-300E-9			1393	GS
NOR-300E-9			1394	HM
NOR-300E-10			1395	GS
NOR-300E-10			1396	HM
NOR-450E-A	41°08.919'	72°53.189'	1397	GS
NOR-450E-A			1398	HM
NOR-450E-B			1399	HM
NOR-450E-C			1400	HM
NOR-450E-1			1401	GS
NOR-450E-1			1402	HM
NOR-450E-2			1403	GS
NOR-450E-2			1404	HM
NOR-450E-3			1405	GS
NOR-450E-3			1406	HM
NOR-450E-4			1407	GS
NOR-450E-4			1408	HM
NOR-450E-5			1409	GS
NOR-450E-5			1410	HM

TABLE 5.0-1 (Continued)

<u>SAMPLE</u>	<u>LATITUDE</u>	<u>LONGITUDE</u>	<u>NUMBER</u>	<u>TYPE</u>
NOR-450E-6	41°08.919'	72°53.189'	1411	GS
NOR-450E-6			1412	HM
NOR-450E-7			1413	GS
NOR-450E-7			1414	HM
NOR-450E-8			1415	GS
NOR-450E-8			1416	HM
NOR-450E-9			1417	GS
NOR-450E-9			1418	HM
NOR-450E-10			1419	GS
NOR-450E-10			1420	HM
NOR-400W-A	41°08.919'	72°53.797'	1421	GS
NOR-400W-A			1422	HM
NOR-400W-B			1423	HM
NOR-400W-C			1424	HM
NOR-300W-A	41°08.919'	72°53.725	1425	GS
NOR-300W-A			1426	HM
NOR-300W-B			1427	HM
NOR-300W-C			1428	HM
NOR-450S-A	41°08.676'	72°53.511'	1429	GS
NOR-450S-A			1430	HM
NOR-450S-B			1431	HM
NOR-450S-C			1432	HM
NOR-550S-A	41°09.135'	72°53.511'	1433	GS
NOR-550S-A			1434	HM
NOR-400N-A	41°09.135'	72°53.511'	1435	GS
NOR-400N-A			1436	HM
NOR-400N-B			1437	HM
NOR-400N-C			1438	HM
NOR-275N-A	41°09.068'	72°53.511'	1439	GS
NOR-275N-A			1440	HM
NOR-275N-A			1441	HM
NOR-275N-B			1442	HM
NOR-275N-B			1443	HM
NOR-275N-C			1444	HM
NOR-275N-C			1445	HM

TABLE 5.0-1 (Continued)

Samples obtained at the center of the pile were characterized by black organic material with a strong odor accompanied by large amounts of grassy material. Grabs 50 meters north and south of the center were similar material but contained evidence of decaying leaves and deposits of sand. Samples from a location 300 m east of center consisted of a slightly oxidized surface veneer over a 2 cm layer of black spoil over red clay. Also present were numerous small live bivalves. At 450 m east of center, the bottom was composed of a 3 cm oxidized layer over that appeared to be natural bottom. To the west, spoil was observed to trail out to a distance of 400 meters from the main pile although recolonization appeared to be extensive as close in as 300 meters west of center. Difficulty was encountered in finding the margins of the mound to the south as no natural bottom was sampled and material from the permit disposal site was encountered at approximately 500 meters south. To the north, black organic spoil mixed with gray clay was encountered at 275 meters. At 400 meters north, the bottom was composed of a 1 cm oxidized layer over dark mud over what appeared to be natural bottom.

Diving operations were conducted at the center of the site and at a location 300 m east of the disposal buoy. At the center of the site, the bottom was flat and featureless with clumps of marsh (Spartina) peat evident. Minor substrate surface bioturbation and obvious excavation zones due to epibenthic activity (burrows, pits, furrows) were commonly sited within each meter of transect distance. Leaf litter accumulated in the lee of protruding clay and Spartina mounds. Occasional mud fragments (2 cm diam. spheres) were clustered in depression areas. A 5 cm

nepheloid layer was observed in the E-W tidal motion at the sediment water interface.

The bottom encountered 300 m east of the disposal buoy was similar to that on the mound, however, the absence of protruding clay and peat mounds was indicative of a non-spoil area. Near slack tide, the unconsolidated floc layer reduced to 2 cm depth over a soft mud natural substrate. Numerous biogenic structures typified the surface substrate.

Biological observations indicated some differences in the benthic populations present on and off the disposal mound. At the center of the site the following organisms were observed.

- Juvenile Fish:
Sea robin Prionotus carolinus, (5)
Pipefish Sygnathus fuscus, (1)
Sand dab Scophthalmus aquosus, (4)
4 spot fluke Paralichthys oblongus (5)
- Mollusks:
Nassarius trivittatus (predominant)
Urosolpanix (50+)
- Crustacea:
Pagarus longicarpus (extremely common 200+)
Cranqon septemspinosa (numerous at chain base 100+)
- Annelids:
Pectinaria
- Other:
Bryozoans (sparse coverage on exposed hard surfaces
i.e. pipe, chain)
Mnemiopsis (common throughout water column)

At the outer dive site the following organisms were observed

- Juvenile fish (the same species composition was represented in off-spoil and on-spoil enumeration).
Four spot flounder Paralichthys oblongus (4)
Sea robin Prionotus carolinus, (5)
Pipefish Sygnathus fuscus (1)

Sand dab Scopthalmus aquosus (2)
Winter flounder Pseudopleuronectes americanus

- Mollusk:
Nassarius trivittatus ubiquitous
Crangon septemspinosa ubiquitous
Squilla empusa (2)
- Other:
Cerianthus americanus

This site differed from the on-spoil survey by the presence of Cerianthus americanus anemones in densities estimated at 1-5 per square meter. Also numerous small vertical burrows 2-3 cm diameter were observed in 5-10 per square meter density. Divers also sighted two live mantis shrimp (squilla) along the course of transect.

Photographs taken during the dives at the Norwalk Disposal Site are presented in Figure 5.0-6 (a-k).

6.0 SUMMARY

The data presented in this report are preliminary results of monitoring surveys made during August, 1981. More extensive analysis, particularly relative to the biological and chemical samples will be available following completion of laboratory procedures.

The Brenton Reef site appears to be relatively unchanged from previous surveys conducted in 1979. The disposal mound persists as a broad gently sloping feature covered with fine sand over gray spoil material. The benthic population immediately adjacent to the mound appears stable and consists primarily of amphipod species.

The Wellfleet site has been drastically altered by leveling of the dredged material mound by fishing draggers. This leveling has dispersed the material over the entire disposal site

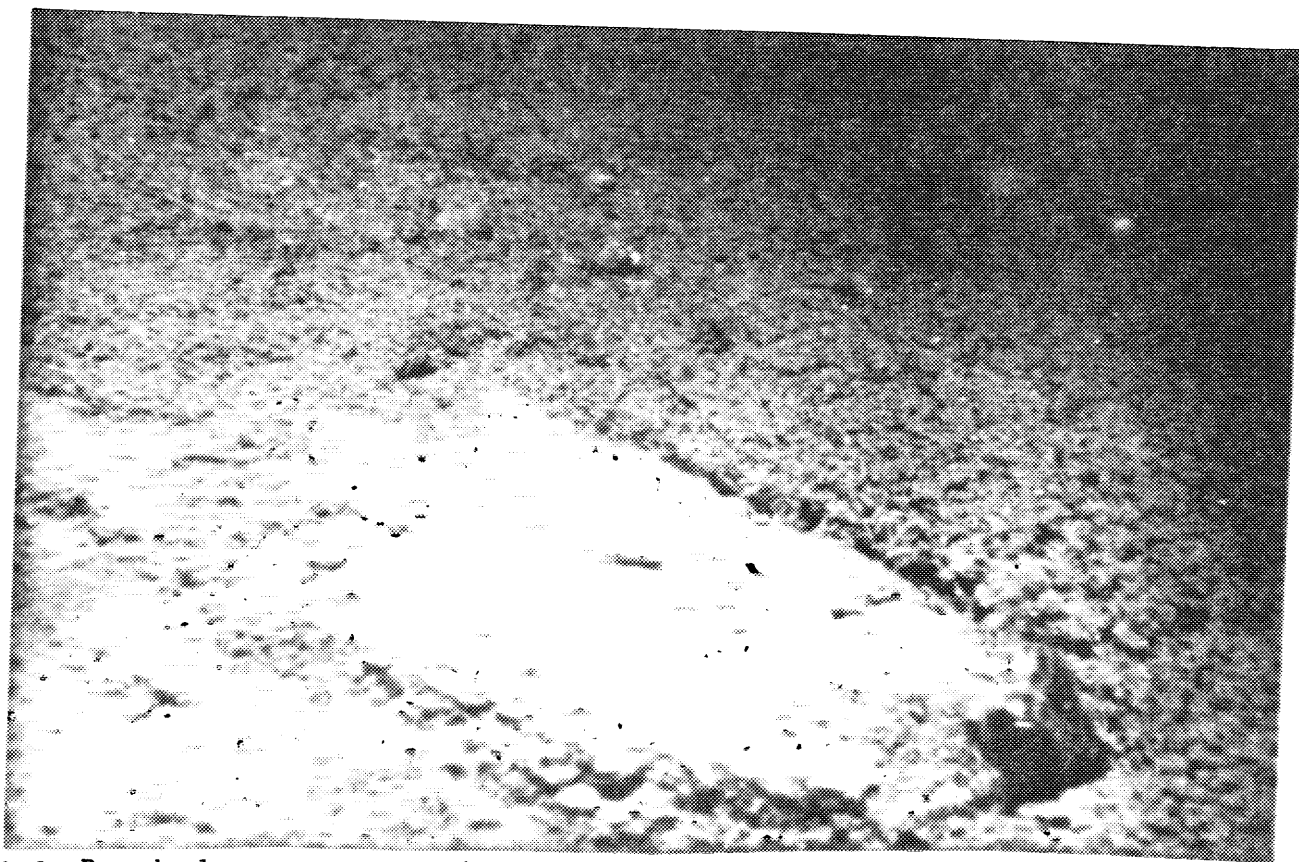


Figure 5.0-6a Pseudopleuronectes americanus winter flounder covered with natural bottom sediment, and several Urosalpinx on surface sediment (background).

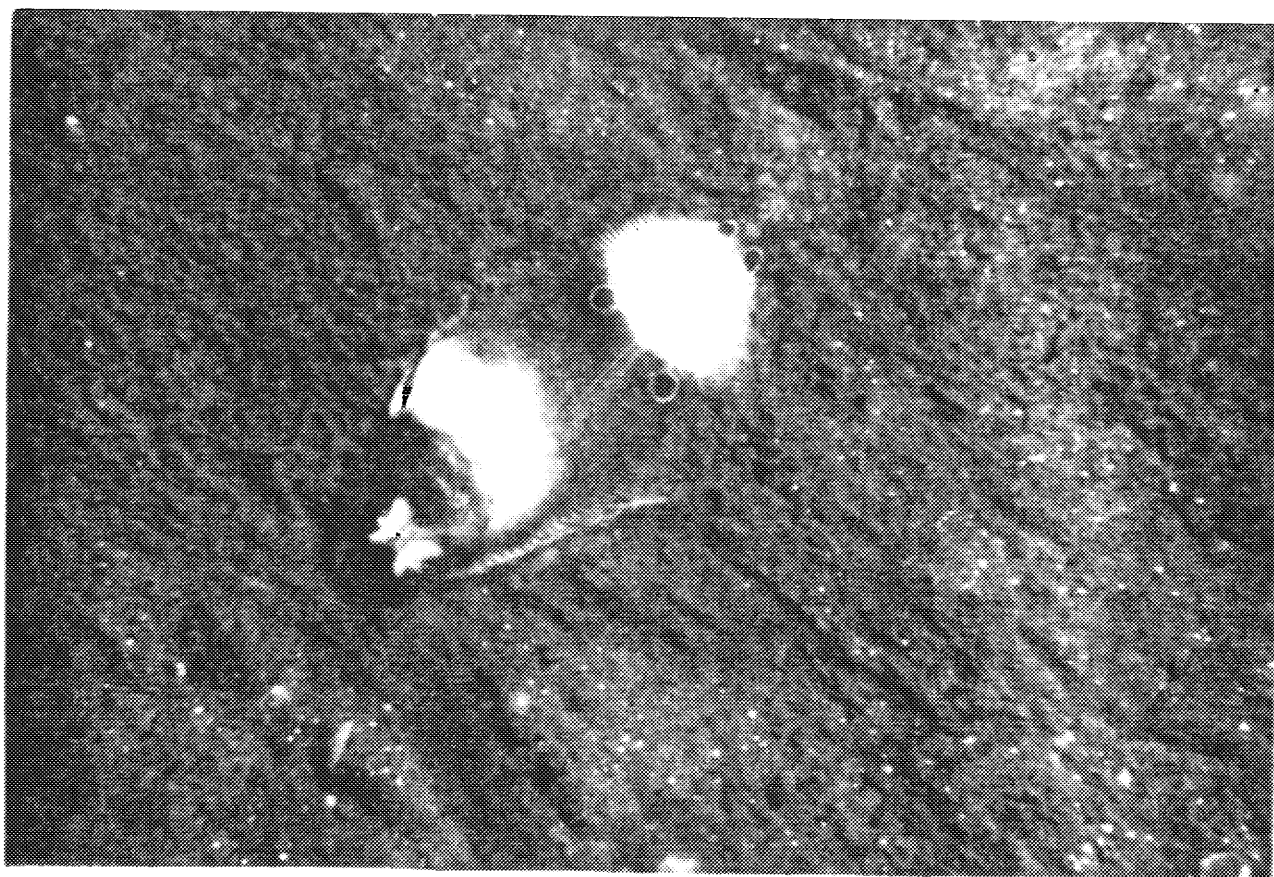
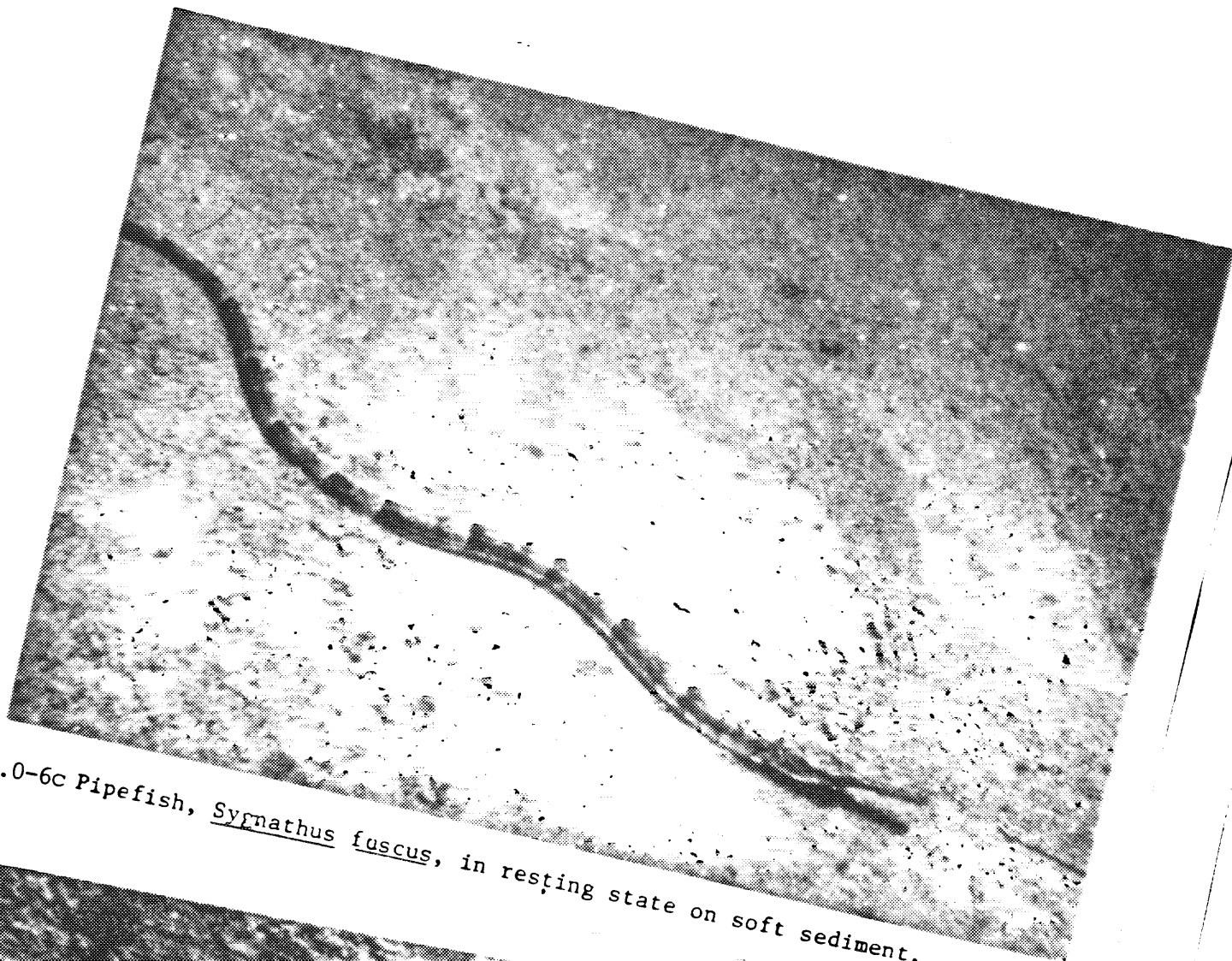
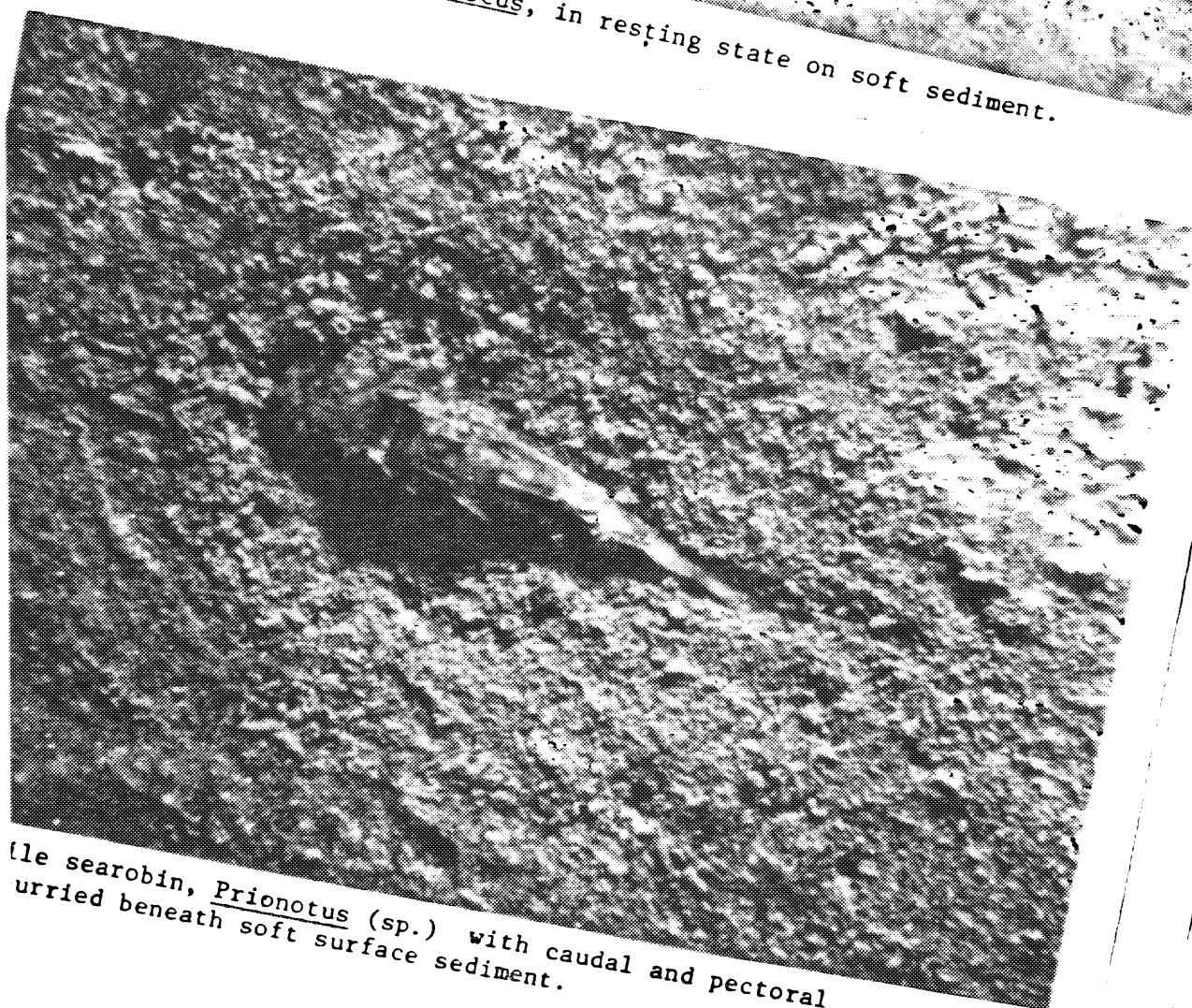


Figure 5.0-6b Fourspot flounder (juvenile) utilizing soft sediment veneer adjacent to Norwalk spoil site.



e 5.0-6c Pipefish, Syrnathus fuscus, in resting state on soft sediment.



tle searobin, Prionotus (sp.) with caudal and pectoral
urried beneath soft surface sediment.

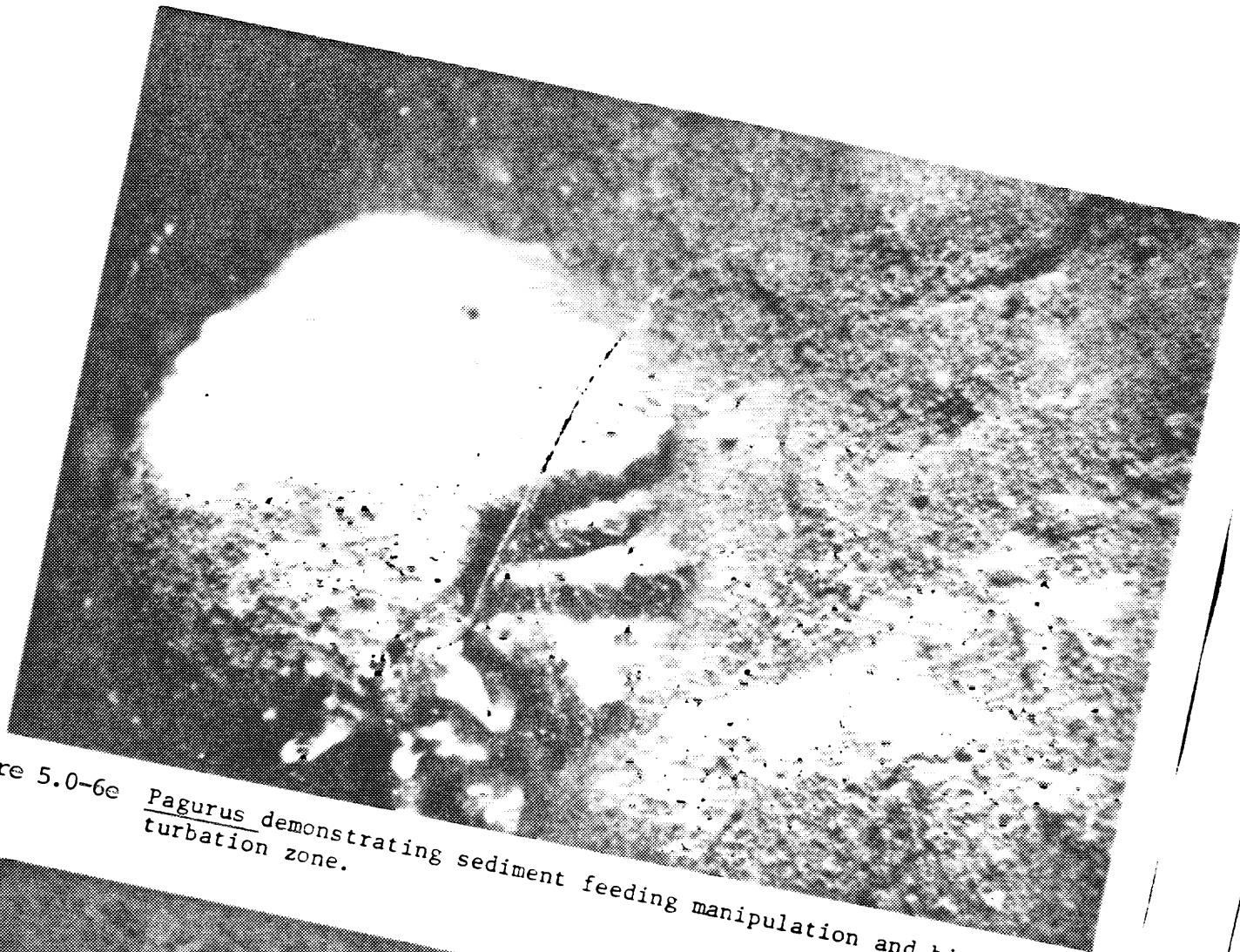


Figure 5.0-6e Pagurus demonstrating sediment feeding manipulation and bio-turbation zone.



is longicarpus on sediment/floculant patch area within
n sector.

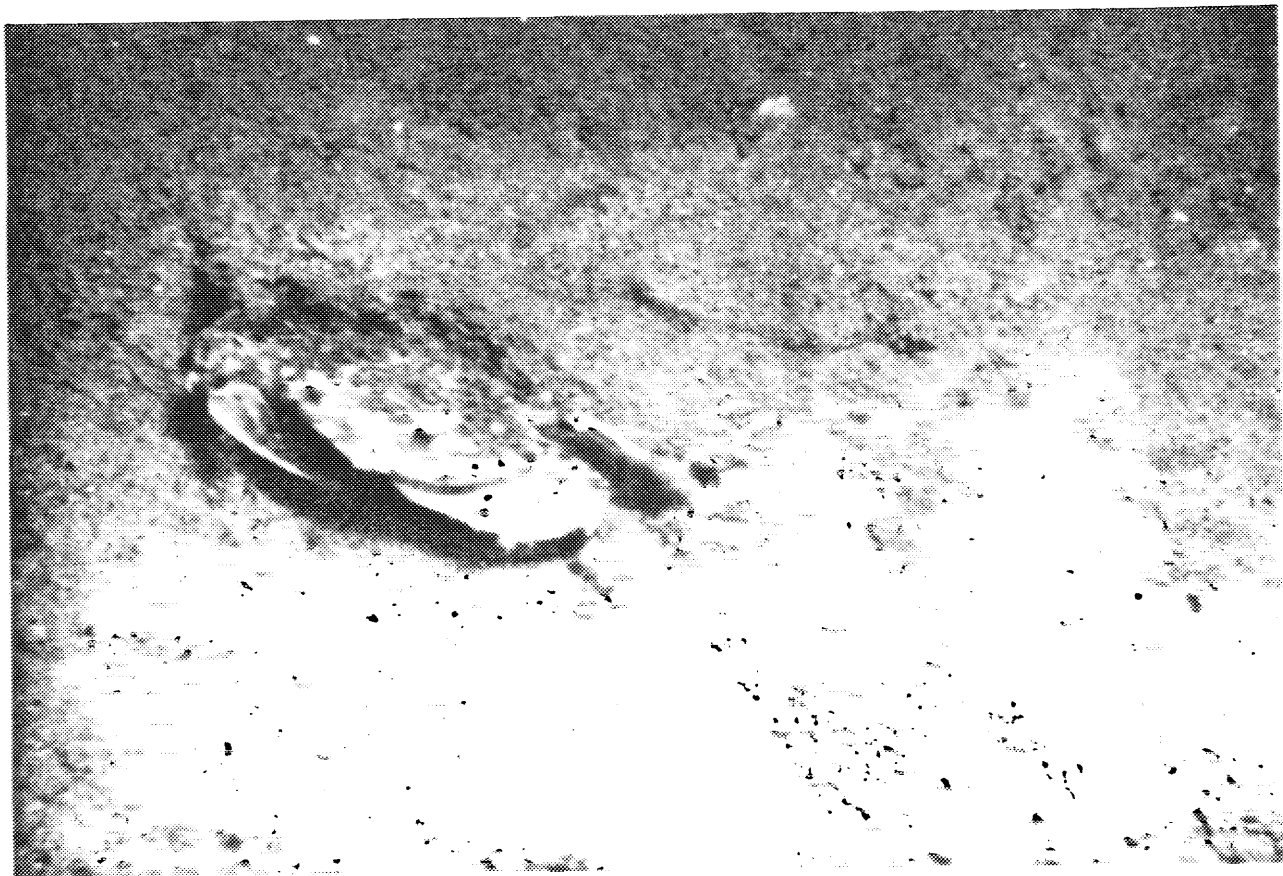


Figure 5.0-6g Calico crab, Ovalipes (juvenile) photographed before complete burial beneath sediment.

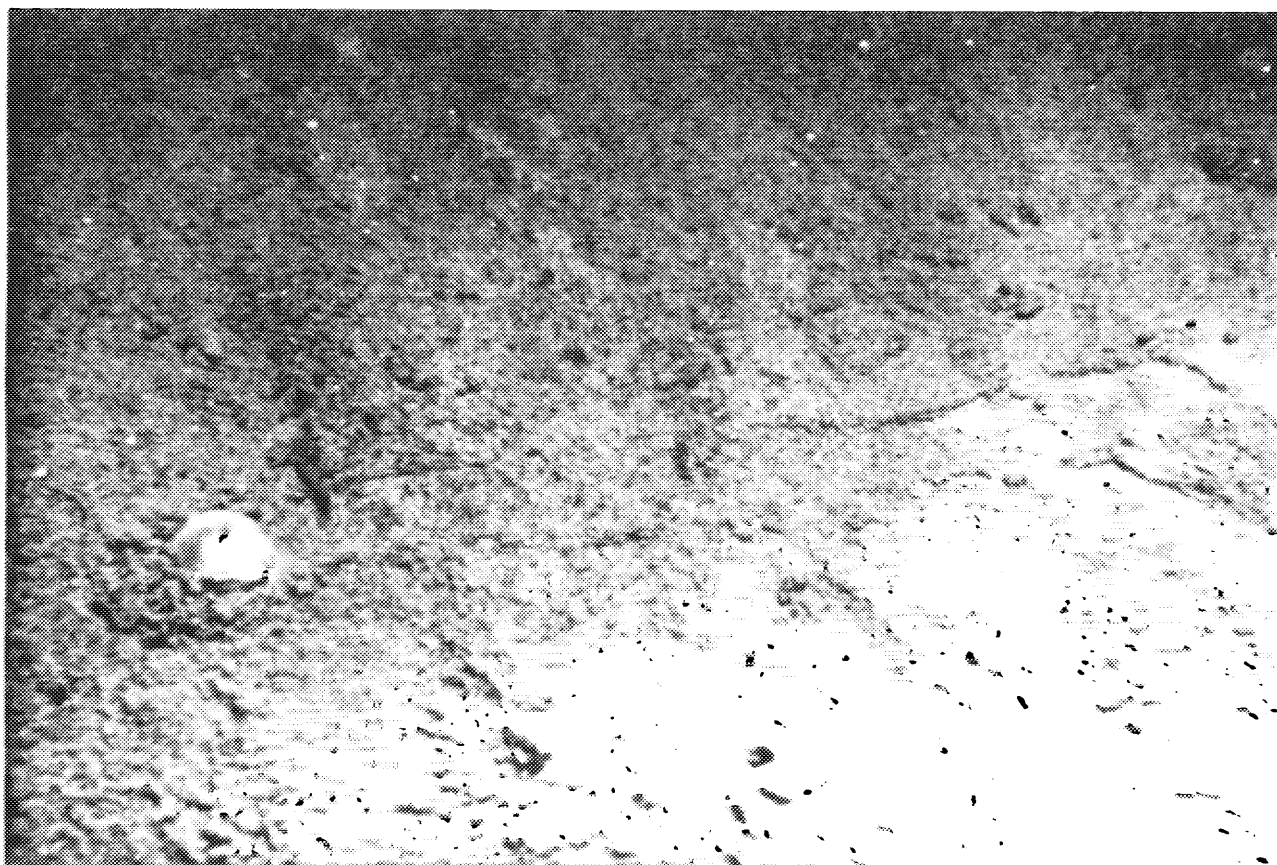


Figure 5.0-6h Juvenile Lunatia leaves mucal track across sediment surface.



Figure 5.0-6i Polychaete Pectinaria cast contributes to sediment composition.

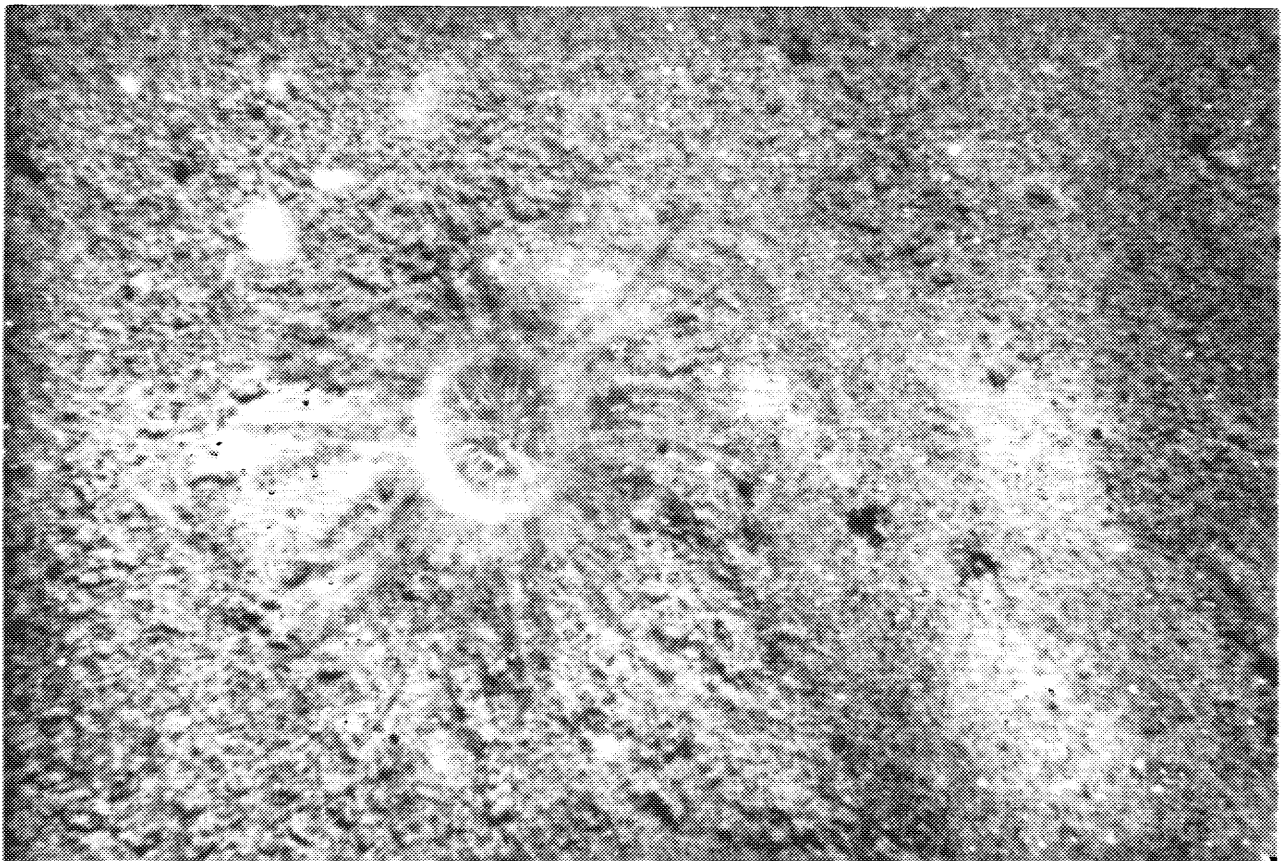


Figure 5.0-6j Cerianthus anemone within substrate with evidence of more consolidated sediment along border of tube. Note natural erosion troughs on either side of burrow tube.

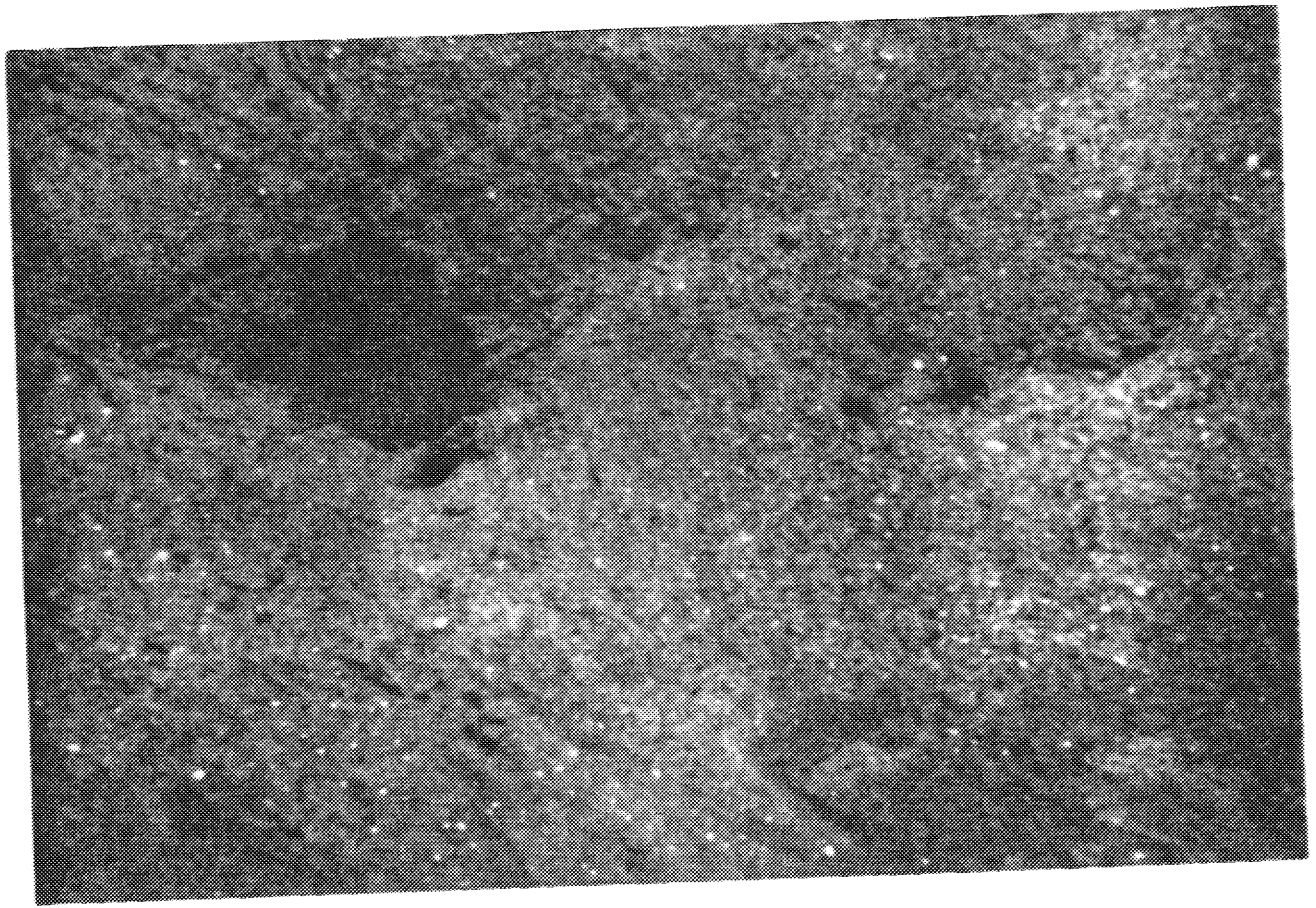


Figure 5.0-6k Vertical burrow assumed to be representative of numerous Squilla type excavation in eastern Norwalk vicinity.

and made identification of material and effects difficult. If further disposal is anticipated only clean material should be deposited as the site cannot be considered a containment site under existing conditions.

The Norwalk site appears stable with two distinct mounds present north and south of the disposal buoy. Since both of these mounds have minimum depths approaching 15 meters, it is advisable to alter the disposal point prior to additional dumping.